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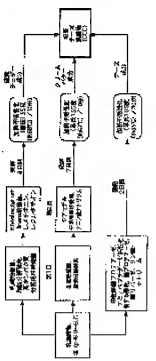
(54) NATURAL BIOGENERATED CHEESE FLAVORING SYSTEM

(57)Abstract:
PROBLEM TO BE SOLVED: To provide a natural biogenerated cheese flavoring system capable of being used for preparing very different cheeses having desired flavor profiles.
SOLUTION: This natural biogenerated cheese flavoring system is characterized by containing a sulfury-cheddar flavor component, creamy-buttery flavor component, and cheesy flavor component; wherein these flavor components each can be used as flavor building blocks with their own specific flavor profiles and/or specific flavor characteristics, cheese with wide variety of flavors can be produced by introducing the various combinations of these flavor components, and these components are independently prepared from milk



substrate highly concentrated by using a composition designed so as to provide flavor components respectively having specific flavor profiles and/or flavor characteristics (e.g. specific enzymes, cultures, and additives), and process conditions.

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
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CLAIMS

[Claim(s)]
[Claim 1]Are a flavor system of a food grade and, in said system, a sulfur Cheddar taste component the 1st milk concentrate including a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component by lactic acid culture. The 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH is obtained, Add a sulfur content substrate into the 1st mixture, form the 2nd mixture, and the 2nd mixture Brevibacterium linens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacterium linens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 3rd mixture will be formed, [about ten days and] It is prepared by processing the 3rd mixture at sufficient temperature to inactivate culture and an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component, and a cream butter flavor ingredient the 2nd milk concentrate by lactic acid culture From about 10 hours to about 24 hours. Process at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), form the 4th mixture, add sodium acid citrate into the 4th mixture, form the 5th mixture, and the 5th mixture by diacetyl generation flavor culture. For [from about one day] about ten days, process by about 90 Fahrenheit (about 32 **) from about 70 Fahrenheit (about 21 **), and the 6th mixture is formed, It is prepared by processing the 6th mixture at sufficient temperature to inactivate culture and an enzyme in the 6th mixture, and forming a cream butter flavor ingredient, A cheese-head taste component the 3rd milk concentrate with lipase, protease, and peptidase. Will process from about 0.5 day at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 7th mixture will be formed, [about ten days and] It is prepared by processing the 7th mixture at sufficient temperature to inactivate an enzyme in the 7th mixture, and forming a cheese-head

taste component, A flavor system mixing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component of said cheese-head flavor system with foodstuffs in various quantity, and being able to generate various flavors.

[Claim 2]The flavor system according to claim 1 which said foodstuffs are cheese products, and is characterized by mixing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component of said flavor system with a cheese head or a dairy-products base in order to manufacture the cheese product.

[Claim 3]The 1st milk concentrate is further processed by stearolytic enzyme and high-protein decomposition activity culture, The flavor system according to claim 2 in order that the 2nd milk concentrate may be processed with stearolytic enzyme and may prepare a sulfur Cheddar taste component further, wherein Brevibacterium linens culture is used.

[Claim 4]The flavor system according to claim 3, wherein sulfur content substrates are L-methionine, L-glutathione, L-cysteine, or those mixtures.

[Claim 5]The 1st milk concentrate, the 2nd milk concentrate, and the 3rd milk concentrate are prepared by the ultrafiltration / diafiltration process, and the 1st milk concentrate, the 2nd milk concentrate, and the 3rd milk concentrate independently, The flavor system according to claim 4 having about 30 to about 50% of the total amount of solid content, about 50 to about 70% of the amount of hygroscopic surface moisture, about 15 to about 27% of fat amount, about 10 to about 20% of protein amount, about 0.5 to about 2% of the amount of lactose, and about 1 to about 3% of salt amount.

[Claim 6]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, And it is Lactococcuslactis subspecies cremoris, The flavor system according to claim 4, wherein stearolytic enzyme used in order to prepare a sulfur Cheddar taste component is rumina esterase and high-protein decomposition activity culture used in order to prepare a sulfur Cheddar taste component is Micrococcus.

[Claim 7]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, They are Lactococcus lactis subspecies cremoris(es) or those mixtures, The flavor system according to claim 5, wherein stearolytic enzyme used in order to prepare a sulfur Cheddar taste component is rumina esterase and high-protein decomposition activity culture used in order to prepare a sulfur Cheddar taste component is Micrococcus.

[Claim 8]Lactic acid culture used in order to prepare a cream butter flavor ingredient, Lactococcus lactis, Lactococcus lactis subspecies cremoris, Or stearolytic enzyme which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Diacetyl generation flavor culture which is rumina esterase, and is used in order to prepare a cream butter flavor ingredient, The flavor system according to claim 4 being Leuconostoc, the Lactococcus lactis subspecies lactis biovars diacetylactis, or those mixtures.

[Claim 9]Lactic acid culture used in order to prepare a cream butter flavor ingredient,

Lactococcus lactis, Lactococcus lactis subspecies cremoris, Or stearolytic enzyme which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Diacetyl generation flavor culture which is rumina esterase, and is used in order to prepare a cream butter flavor ingredient, The flavor system according to claim 5 being Leuconostoc, the Lactococcus lactis subspecies lactis biovars diacetylactis, or those mixtures.

[Claim 10]Lipase used in order to prepare a cheese-head taste component is bacillus lipase, Protease used in order to prepare a cheese-head taste component Neutral bacterial protease, The flavor system according to claim 4, wherein it is bacillus protease or those mixtures and peptidase used in order to prepare a cheese-head taste component is of Lactobacillus helveticus origin.

[Claim 11]Lipase used in order to prepare a cheese-head taste component is bacillus lipase, Protease used in order to prepare a cheese-head taste component Neutral bacterial protease, The flavor system according to claim 5, wherein it is bacillus protease or those mixtures and peptidase used in order to prepare a cheese-head taste component is of Lactobacillus helveticus origin.

[Claim 12]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, And it is Lactococcus lactis subspecies cremoris, Stearolytic enzyme used in order to prepare a sulfur Cheddar taste component, High-protein decomposition activity culture which is rumina esterase, and is used in order to prepare a sulfur Cheddar taste component, Lactic acid culture which is Micrococcus, and is used in order to prepare a cream butter flavor ingredient, Lactococcus lactis, Lactococcus lactis subspecies cremoris, Or stearolytic enzyme which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Diacetyl generation flavor culture which is rumina esterase, and is used in order to prepare a cream butter flavor ingredient, Leuconostoc, the Lactococcus lactis subspecies lactis biovar diacetylactis. Protease which it is those mixtures and lipase used in order to prepare a cheese-head taste component is bacillus lipase, and is used in order to prepare a cheese-head taste component Or neutral bacterial protease, The flavor system according to claim 4, wherein it is bacillus protease or those mixtures and peptidase used in order to prepare a cheese-head taste component is of Lactobacillus helveticus origin.

[Claim 13]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, And it is Lactococcus lactis subspecies cremoris, Stearolytic enzyme used in order to prepare a sulfur Cheddar taste component, High-protein decomposition activity culture which is rumina esterase, and is used in order to prepare a sulfur Cheddar taste component, Lactic acid culture which is Micrococcus, and is used in order to prepare a cream butter flavor ingredient, Lactococcus lactis, Lactococcus lactis subspecies cremoris, Or stearolytic enzyme which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Diacetyl generation flavor culture which is rumina esterase, and is used in

order to prepare a cream butter flavor ingredient, Leuconostoc, the Lactococcus lactis subspecies lactis biovar diacetylactis. Protease which it is those mixtures and lipase used in order to prepare a cheese-head taste component is bacillus lipase, and is used in order to prepare a cheese-head taste component Or neutral bacterial protease, The flavor system according to claim 5, wherein it is bacillus protease or those mixtures and peptidase used in order to prepare a cheese-head taste component is of Lactobacillus helveticus origin.

[Claim 14]The flavor system according to claim 4 a sulfur Cheddar taste component is dried, a powder sulfur Cheddar taste component is formed and drying a cream butter flavor ingredient, forming a powdered cream butter flavor ingredient, drying a cheese-head taste component, and forming a powder cheese-head taste component.

[Claim 15]The flavor system according to claim 5 a sulfur Cheddar taste component is dried, a powder sulfur Cheddar taste component is formed and drying a cream butter flavor ingredient, forming a powdered cream butter flavor ingredient, drying a cheese-head taste component, and forming a powder cheese-head taste component.

[Claim 16]The flavor system according to claim 12 a sulfur Cheddar taste component is dried, a powder sulfur Cheddar taste component is formed and drying a cream butter flavor ingredient, forming a powdered cream butter flavor ingredient, drying a cheese-head taste component, and forming a powder cheese-head taste component.

[Claim 17]The flavor system according to claim 13 a sulfur Cheddar taste component is dried, a powder sulfur Cheddar taste component is formed and drying a cream butter flavor ingredient, forming a powdered cream butter flavor ingredient, drying a cheese-head taste component, and forming a powder cheese-head taste component.

[Claim 18]A method characterized by comprising the following of preparing a flavoring cheese head using a culture cheese-head concentrate.

Said method prepares (1) cheese head or a dairy-products base.

2) It includes mixing about 1 to about 10% of culture cheese-head concentrate with a cheese head or a dairy-products base, and forming a flavoring cheese head, Said culture cheese-head concentrate 0 to about 80% of sulfur Cheddar taste component, A sulfur Cheddar taste component the 1st milk concentrate including about 10 to about 90% of cream butter flavor ingredient, and about 10 to about 90% of cheese-head taste component by lactic acid culture. It processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and is about 5.4 or less pH.

[Claim 19]The 1st milk concentrate is further processed by stearolytic enzyme and high-protein decomposition activity culture, A method according to claim 18 in order that the 2nd milk concentrate may be processed with stearolytic enzyme and may prepare a sulfur Cheddar taste component further, wherein Brevibacteriumlinens culture is used.

[Claim 20]A method according to claim 19 that a sulfur content substrate is characterized by being L-methionine, L-glutathione, L-cysteine, or those mixtures.
[Claim 21]A method according to claim 19 that a culture cheese-head concentrate is characterized by including about 75% and about 25% of a cheese-head taste component to about 75% from about 25% of a cream butter flavor ingredient about 75% from about 25% of a sulfur Cheddar taste component.
[Claim 22]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, And it is Lactococcus lactis subspecies cremoris, Stearolytic enzyme used in order to prepare a sulfur Cheddar taste component, High-protein decomposition activity culture which is rumina esterase, and is used in order to prepare a sulfur Cheddar taste component, Lactic acid culture which is Micrococcus, and is used in order to prepare a cream butter flavor ingredient, Lactococcus lactis, Lactococcuslactis subspecies cremoris, Or stearolytic enzyme which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Diacetyl generation flavor culture which is rumina esterase, and is used in order to prepare a cream butter flavor ingredient, Leuconostoc, the Lactococcus lactis subspecies lactis biovar diacetylactis. Protease which it is those mixtures and lipase used in order to prepare a cheese-head taste component is bacillus lipase, and is used in order to prepare a cheese-head taste component Or neutral bacterial protease, A method according to claim 19 that it is bacillus protease or those mixtures, and peptidase used in order to prepare a cheese-head taste component is characterized by being of Lactobacillus helveticus origin.
[Claim 23]A method according to claim 19, wherein it is a culture cheese-head concentrate in the end of dried powder.
[Claim 24]A method according to claim 22, wherein it is a culture cheese-head concentrate in the end of dried powder.
[Claim 25]A method characterized by comprising the following of preparing a flavoring cheese head using a culture cheese-head concentrate.
Said method prepares a milk substrate suitable for manufacture of (1) cheese head.
2) Mix about 1 to about 10% of culture cheese-head concentrate with a milk substrate.
3) Process a milk substrate and a culture cheese-head concentrate, and solidify a milk substrate.
4) Cutting a coagulation milk substrate and forming a card and whey, (5) cards, and whey are cooked, (6) Include separating a card from whey, and forming a flavoring cheese head from a card which carried out (7) separation, Said culture cheese-head concentrate 0 to about 80% of sulfur Cheddar taste component, A sulfur Cheddar taste component the 1st milk concentrate including about 10 to about 90% of cream butter flavor ingredient, and about 10 to about 90% of cheese-head taste component by lactic acid culture. It processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **),

and is about 5.4 or less pH.

[Claim 26]The 1st milk concentrate is further processed by stearolytic enzyme and high-protein decomposition activity culture, A method according to claim 25 in order that the 2nd milk concentrate may be processed with stearolytic enzyme and may prepare a sulfur Cheddar taste component further, wherein Brevibacteriumlinens culture is used.
[Claim 27]A method according to claim 25 that a sulfur content substrate is characterized by being L-methionine, L-glutathione, L-cysteine, or those mixtures.
[Claim 28]A method according to claim 25 that a culture cheese-head concentrate is characterized by including about 75% and about 25% of a cheese-head taste component to about 75% from about 25% of a cream butter flavor ingredient about 75% from about 25% of a sulfur Cheddar taste component.
[Claim 29]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, And it is Lactococcus lactis subspecies cremoris, Stearolytic enzyme used in order to prepare a sulfur Cheddar taste component, High-protein decomposition activity culture which is rumina esterase, and is used in order to prepare a sulfur Cheddar taste component, Lactic acid culture which is Micrococcus, and is used in order to prepare a cream butter flavor ingredient, Lactococcus lactis, Lactococcuslactis subspecies cremoris, Or stearolytic enzyme which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Diacetyl generation flavor culture which is rumina esterase, and is used in order to prepare a cream butter flavor ingredient, Leuconostoc, the Lactococcus lactis subspecies lactis biovar diacetylactis. Protease which it is those mixtures and lipase used in order to prepare a cheese-head taste component is bacillus lipase, and is used in order to prepare a cheese-head taste component Or neutral bacterial protease, A method according to claim 27 that it is bacillus protease or those mixtures, and peptidase used in order to prepare a cheese-head taste component is characterized by being of Lactobacillus helveticus origin.
[Claim 30]A method according to claim 27, wherein it is a culture cheese-head concentrate in the end of dried powder.
[Claim 31]A method according to claim 29, wherein it is a culture cheese-head concentrate in the end of dried powder.
[Claim 32]Are a sulfur Cheddar taste component for using for flavoring of a cheese head, and said sulfur Cheddar taste component a milk concentrate by lactic acid culture. The 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH is obtained, Add a sulfur content substrate into the 1st mixture, form the 2nd mixture, and the 2nd mixture Brevibacterium linens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacterium linens culture or yeast can convert a sulfur content substrate into a

sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 3rd mixture will be formed, [about ten days and] A sulfur Cheddar taste component preparing by processing the 3rd mixture at sufficient temperature to inactivate an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component.

[Claim 33]The sulfur Cheddar taste component according to claim 32 in order that a milk concentrate may be processed by stearolytic enzyme and high-protein decomposition activity culture and may prepare a sulfur Cheddar taste component further, wherein Brevibacterium linens culture is used.

[Claim 34]The sulfur Cheddar taste component according to claim 33, wherein sulfur content substrates are L-methionine, L-glutathione, L-cysteine, or those mixtures.

[Claim 35]Lactic acid culture is Lactococcus lactis and Lactococcus lactis subspecies cremoris, The sulfur Cheddar taste component according to claim 34, wherein stearolytic enzyme is rumina esterase and high-protein decomposition activity culture is Micrococcus.

[Claim 36]The sulfur Cheddar taste component according to claim 33, wherein it is a sulfur Cheddar taste component in the end of dried powder.

[Claim 37]The sulfur Cheddar taste component according to claim 34, wherein it is a sulfur Cheddar taste component in the end of dried powder.

[Claim 38]Are a flavor system of a food grade and said system A sulfur Cheddar taste component, a cream butter flavor ingredient, A sulfur Cheddar taste component the 1st milk concentrate including a cheese-head taste component And lactic acid culture, A sulfur content substrate and Brevibacterium linens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacterium linens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 1st mixture will be formed, [about ten days and] It is prepared by processing the 1st mixture at sufficient temperature to inactivate culture and an enzyme in the 1st mixture, and forming a sulfur Cheddar taste component, A cream butter flavor ingredient will process the 2nd milk concentrate from about one day at temperature of about 70 (about 21 **) to about 90 Fahrenheit (about 32 **) with lactic acid culture, diacetyl generation flavor culture, and sodium acid citrate, and will form the 2nd mixture, [about ten days and] It is prepared by processing the 2nd mixture at sufficient temperature to inactivate culture and an enzyme in the 2nd mixture, and forming a cream butter flavor ingredient, A cheese-head taste component the 3rd milk concentrate with lipase, protease, and peptidase. Will process from about 0.5 day at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 3rd mixture will be formed, [about ten days and] It is prepared by processing the 3rd mixture at sufficient temperature to inactivate an enzyme in the 3rd mixture, and forming a cheese-head

taste component, A flavor system mixing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component of said cheese-head flavor system with foodstuffs in various quantity, and being able to generate various flavors.

[Claim 39]The flavor system according to claim 38 which said foodstuffs are cheese products, and is characterized by mixing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component of said flavor system with a cheese head or a dairy-products base in order to manufacture the cheese product.

[Claim 40]The 1st milk concentrate is further processed by stearolytic enzyme and high-protein decomposition activity culture, The flavor system according to claim 39 in order that the 2nd milk concentrate may be processed with stearolytic enzyme and may prepare a sulfur Cheddar taste component further, wherein Brevibacteriumlinens culture is used.

[Claim 41]The flavor system according to claim 40, wherein sulfur content substrates are L-methionine, L-glutathione, L-cysteine, or those mixtures.

[Claim 42]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, And it is Lactococcus lactis subspecies cremoris, Lactic acid culture used in order to prepare a cream butter flavor ingredient, Lactococcus lactis, Lactococcus lactis subspecies cremoris, Or diacetyl generation flavor culture which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Leuconostoc, the Lactococcus lactis subspecies lactis biovar diacetylactis. Or lipase which is those mixtures, and is used in order to prepare a cheese-head taste component, Protease which is bacillus lipase, and is used in order to prepare a cheese-head taste component, The flavor system according to claim 39, wherein it is neutral bacterial protease, bacillus protease, or those mixtures and peptidase used in order to prepare a cheese-head taste component is of Lactobacillushelveticus origin.

[Claim 43]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, And it is Lactococcus lactis subspecies cremoris, Stearolytic enzyme used in order to prepare a sulfur Cheddar taste component, High-protein decomposition activity culture which is rumina esterase, and is used in order to prepare a sulfur Cheddar taste component, Lactic acid culture which is Micrococcus, and is used in order to prepare a cream butter flavor ingredient, Lactococcus lactis, Lactococcuslactis subspecies cremoris, Or stearolytic enzyme which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Diacetyl generation flavor culture which is rumina esterase, and is used in order to prepare a cream butter flavor ingredient, Leuconostoc, the Lactococcus lactis subspecies lactis biovar diacetylactis. Protease which it is those mixtures and lipase used in order to prepare a cheese-head taste component is bacillus lipase, and is used in order to prepare a cheese-head taste component Or neutral bacterial protease, The flavor system according to claim 40, wherein it is bacillus protease or those mixtures and peptidase used in order to prepare a cheese-head taste component is of Lactobacillus helveticus origin.

[Claim 44]Lactic acid culture used in order to prepare a sulfur Cheddar taste component Lactococcus lactis, And it is Lactococcus lactis subspecies cremoris, Stearolytic enzyme used in order to prepare a sulfur Cheddar taste component, High-protein decomposition activity culture which is rumina esterase, and is used in order to prepare a sulfur Cheddar taste component, Lactic acid culture which is Micrococcus, and is used in order to prepare a cream butter flavor ingredient, Lactococcus lactis, Lactococcuslactis subspecies cremoris, Or stearolytic enzyme which is those mixtures, and is used in order to prepare a cream butter flavor ingredient, Diacetyl generation flavor culture which is rumina esterase, and is used in order to prepare a cream butter flavor ingredient, Leuconostoc, the Lactococcus lactis subspecies lactis biovar diacetylactis. Protease which it is those mixtures and lipase used in order to prepare a cheese-head taste component is bacillus lipase, and is used in order to prepare a cheese-head taste component Or neutral bacterial protease, The flavor system according to claim 41, wherein it is bacillus protease or those mixtures and peptidase used in order to prepare a cheese-head taste component is of Lactobacillus helveticus origin.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to the natural living thing generation cheese-head flavor system which can be used in order to prepare a very much different cheese head which generally has a desired flavor profile. This invention relates to details more at the natural living thing generation cheese-head flavor system containing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component. Each of these taste components can be used as a flavor constitutional unit provided with a respectively specific flavor profile and/or the flavor characteristic. By using combination with these various taste components, the cheese head which has various flavors can be manufactured easily. These taste components are independently prepared from the milk substrate condensed highly using the ingredient (for example, a specific enzyme, culture, and an additive agent) and process condition which were designed provide the taste component which has a specific flavor profile and/or the flavor characteristic. These taste components can be used for process cheese, natural cheese, or other cheese heads in order to manufacture a very much different cheese head provided with the desired flavor profile. This flavor concentrate can also be used for other foodstuffs as a natural flavor system.
[0002]
[Description of the Prior Art]Generally, natural cheese makes milk reveal acidity and is made solidifying milk with coagulants, such as rennet, or by making acidity reveal till a proteinic isoelectric point. This coagulation milk is cut and whey is separated from the card to produce. A card can be pressurized and a cheese block can be provided. Hardening is typically performed over very long time under a control condition. for example, a cheddar cheese exceeds one year, in order to harden for at least four months and to obtain flavor with a sufficient request for a cheddar cheese -- period hardening may be carried out.

[0003]It is well known by grinding natural cheese and heating with an emulsification salt that the product which has some characteristics of natural cheese is provided. The name conferred upon the product produced as a result is decided by the used ingredient and its presentation, and is determined by the control criteria released to the U.S. Food and Drug Administration 21CFR133 paragraphs 169-180 depending on the case. For example, depending on an emulsification salt and the case, acid is added an emulsifier and usually, and the term of "pasteurization process cheese" points out the product containing the cheese-head compound which was processed into a plastic material homogeneous next and heated. The flavor of process cheese depends for the natural cheese (it super-riped for four months) held for a long period of time on using at a high rate. Use of the cheese head held for a long period of time increases the cost of process cheese for storage and an inventory carrying cost. The yield of the natural cheese manufactured by the usual method is comparatively low, generally about 45.36 kg (100 pounds) of milk hits, and about 4.54-5.44 kg (about 10-12 pounds) of cheese heads are manufactured. This also increases cost.

[0004]The term of "pasteurization process cheese foodstuffs" points out the product prepared from the same material as being used for manufacture of process cheese, and the same method. However, generally dairy-products ingredients, such as cream, milk, skim milk, whey, or a thing (for example, concentration skim milk) that removed some water from those either, are added by such cheese food. Generally the amount of hygroscopic surface moisture of process cheese foodstuffs can be higher than process cheese, and can be to about 44%. Generally a fat exists in not less than 23% of quantity.

[0005]In the point that the shown dairy-products ingredient can be contained, the term of a "pasteurization process cheese spread" points out a product similar to cheese food. However, the process cheese spread can have about 60% of the high amount of hygroscopic surface moisture, and 20% of the minimum fat amount.

[0006]Since those manufacturing methods and presentations are determined by Federal Standards of Identity, process cheese, process cheese foodstuffs, and a process cheese spread are called a "standardized product."

[0007]In this specification, it is known by the term of "process cheese type products" as "pasteurization process cheese", "pasteurization process cheese foodstuffs", a "pasteurization process cheese spread", and "pasteurization process cheese products", and the product called such is contained in it. Although "process cheese type products" is similar to process cheese, process cheese foodstuffs, a process cheese spread, and process cheese products further, In the point that the ingredient which is not specified as U.S. Federal Standards of Identity is contained, or vegetable oil or vegetable protein may not satisfy the requirements for a presentation of such a standard, The product which may not meet the standard about one of above-mentioned products is included. It is not concerned with whether for process cheese

type products not to be further concerned with the used ingredient or manufacturing stage, and to meet the standard, but flavor similar to process cheese type products and the product which has textures are included.

[0008]Many efforts have been made in order to generate the strong and flavored cheese-head ingredient which can be used for process cheese in a short period. For example, U.S. Pat. No. 4752483 is aimed at the method of generating the cheese-head ingredient flavored strongly. In this method, cheese curd is generated first, the "green" Cheddar type cheese curd produced as a result is ground, and then it will incubate for six days from about five days together with protease, lipase, and water. The term of "green" Cheddar type cheese curd points out the cheddar cheese which riped [less than] on about the 60th.

[0009]U.S. Pat. No. 4172900 is aimed at manufacturing the natural cheese products which have the American cheese-head flavor which was adapted in order to use for preparation of process cheese, and which was reinforced remarkably. In this method, cheese curd is generated by the usual method of manufacturing milk well coagulums, cutting a coagulum and forming a card and whey, and carrying out the effluent of this whey and forming cheese curd. enough to generate the particles of a card and generate C_2 of the quantity which was mixed with the salt, the source of stearolytic enzyme, and the source of protease, and increased compared with the usual American type cheese head - C_{10} fatty acid -- period hardening is carried out.

[0010]U.S. Pat. No. 4119732 is aimed at the method of manufacturing a cheese head promptly. In this method, rennet, kid goat lipase, and calf lipase are mixed for milk during a fermentation period. Next, this milk is solidified and it processes by the usual procedure of manufacturing the cheddar cheese which cuts and includes the effluent stage of whey in card particles continuously. The cheddar cheese flavor which formed this card in the cheese block, riped the cheese block for about ten weeks, and riped about intensity is provided.

[0011]U.S. Pat. No. 3975544 has indicated how to manufacture the pasteurization milk well cheddar cheeses which add an enzyme mixture on a cheddaring card, in order to shorten the cure time of a cheese block substantially. This cheese block is hardened for one month at 10 to 25 **.

[0012]U.S. Pat. No. 4244971 is aimed at the method of manufacturing a cheese product promptly. In this method, a culture cheese-head ingredient carries out protein breakdown of the milk protein, carries out lipolysis of the milk fat, and is prepared by forming the mixed fermented material of such hydrolysis materials. This mixed fermented material is fermented together with a cheese starter culture, and a culture cheese-head ingredient is provided. Next, a culture cheese-head ingredient is mixed with a milk protein concentrate and a fat concentrate. This mixture is fermented and the cheese-head material which can make process cheese type products by the usual cheese-head cooking technique is provided.

[0013]Simultaneous pendency U.S. patent application 09th which applies on May 19, 1999 and the same grantee as this application owns / No. 314713, Processing using protease was performed before the heating stage, and the method of manufacturing enzyme denaturation cheese-head flavoring that this enzyme treatment was a short time comparatively (namely, usually less than about 12 hours) was provided. The stage of contacting the fluid of the dairy products containing (i) whey protein to protease, and providing this method with a dairy-products reaction mixture, (ii) Sufficient period to hydrolyze protein selectively, the stage which incubates a dairy-products reaction mixture at sufficient temperature, (iii) The stage which pasteurizes at low temperature the dairy-products reaction mixture hydrolyzed selectively, (iv) Contact a pasteurization mixture to the constituent containing lipase and cheese-head culture, Sufficient time to reveal cheese-head flavor, the stage which incubates at sufficient temperature, and (v) culture were inactivated, the microorganism impurity was annihilated, the stage of processing a fermentative mixture with sufficient heat to inactivate an enzyme was included, and enzyme denaturation cheese-head flavoring was provided by it.
[0014]Simultaneous pendency U.S. patent application 09th which applies on August 27, 1998 and the same grantee as this application owns / No. 141082, The method of manufacturing the ingredient which is used for manufacturing a cheese head for a short period of time and which was flavored strongly was provided without [without it uses a whey effluent stage, or] generating cheese curd. The cheese-head flavor catalyst precursor (namely, aquosity, acidification protein, and a fat substrate) was prepared by setting desiccation or a concentration protein source, the source of a fat, an acid source, and water, and mixing. Next, the enzyme system was added to this substrate. Lipase, protease, and peptidase were contained in the enzyme system. Next, sufficient time to provide the cheese-head flavor remarkably revealed in the substrate and this substrate were fermented. Then, the substrate was heated to sufficient temperature to inactivate an enzyme system, and it held at the temperature sufficient time.
[0015]Although these methods generally provide the cheese-head ingredient flavored strongly, they are restricted to the flavor profile suitable for generally manufacturing a single kind of flavoring cheese head. Therefore, the cheese head which has a flavor profile of a greatly different request cannot be manufactured using these methods. Each of these methods has the sharp Cheddar scent tone, or does not generate the cheese-head ingredient which gives it and which was flavored strongly.
[0016]
[Problem(s) to be Solved by the Invention]Therefore, it is desirable to provide the cheese-head flavor system which can prepare the cheese head which has a flavor profile which a request is large and is different by it. It is desirable to provide the cheese-head flavor system which can reproduce the flavoring cheese head of various requests only using a small number of taste

component. It is desirable to provide the cheese-head ingredient which has the sharp Cheddar scent tone and which was flavored strongly. This invention has such a cheese-head flavor system and the sharp Cheddar scent tone, or provides the cheese-head ingredient which gives it and which was flavored strongly.

[0017]

[Means for Solving the Problem]This invention relates to a natural living thing generation cheese-head flavor system which can be used in order to prepare a cheese head which has a desired flavor profile generally. This invention relates to details more at a cheese-head flavor system containing a "sulfur Cheddar" taste component, a "cream butter" taste component, and a "cheese-head" taste component. Each of these taste components can be used as a flavor constitutional unit provided with a respectively specific flavor profile and/or the flavor characteristic. A cheese head which has various flavors can be manufactured by using combination with these various taste components (namely, culture cheese-head concentrate of this invention). These flavor concentrates are independently prepared from a milk substrate condensed highly using an enzyme, culture, an additive agent, and a process condition which were designed provide a taste component which has a specific flavor profile and/or the flavor characteristic. These flavor concentrates can be used in order to prepare process cheese provided with a desired flavor profile, or other cheese heads. This flavor concentrate can be added to a milk substrate used in order to manufacture a cheese head, and after that, a milk substrate is processed in order to manufacture a desired cheese head. In order to manufacture a desired cheese head as an exception method, this flavor concentrate can be added at a cheese head or a dairy-products base (namely, cheese curd and/or dairy-products solid content without a desired flavor profile). This flavor concentrate can also be used for other foodstuffs as a natural flavor system.

[0018]Provide this invention and a flavor system containing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component a sulfur Cheddar taste component, The 1st milk concentrate by lactic acid culture and option by stearolytic enzyme and high-protein decomposition activity culture. The 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH is obtained, Add a sulfur content substrate into the 1st mixture, form the 2nd mixture, and the 2nd mixture Brevibacteriumlinens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacteriumlinens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 3rd mixture will be formed, [about ten days and] It is prepared by processing the 3rd mixture at sufficient temperature to inactivate culture and an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component, and a cream butter flavor

ingredient the 2nd milk concentrate Lactic acid culture, By option, using stearolytic enzyme From about 10 hours to and about 24 hours. Process at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), form the 4th mixture, add sodium acid citrate into the 4th mixture, form the 5th mixture, and the 5th mixture by diacetyl generation flavor culture. For [from about one day] about ten days, process by about 90 Fahrenheit (about 32 **) from about 70 Fahrenheit (about 21 **), and the 6th mixture is formed, By processing the 6th mixture at sufficient temperature to inactivate culture and an enzyme in the 6th mixture, and forming a cream butter flavor ingredient, it is prepared and a cheese-head taste component, Lipase, protease, and peptidase are used for the 3rd milk concentrate, Will process from about 0.5 day at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 7th mixture will be formed, [about ten days and] It is prepared by processing the 7th mixture at sufficient temperature to inactivate an enzyme in the 7th mixture, and forming a cheese-head taste component, A sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component of this cheese-head flavor system can be mixed with foodstuffs in various quantity, and can generate various flavors. In order that especially a flavor system of this invention may manufacture a cheese product, it conforms to mixing with a cheese head or a dairy-products base.

[0019]Provide this invention further and a cheese-head flavor system containing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component a sulfur Cheddar taste component, The 1st milk concentrate by stearolytic enzyme and option by lactic acid culture and option High-protein decomposition activity culture, A sulfur content substrate and Brevibacterium linens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacterium linens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 1st mixture will be formed, [about ten days and] By processing the 1st mixture at sufficient temperature to inactivate culture and an enzyme in the 1st mixture, and forming a sulfur Cheddar taste component, it is prepared and a cream butter flavor ingredient, The 2nd milk concentrate using stearolytic enzyme, diacetyl generation flavor culture, and sodium acid citrate by lactic acid culture and option From about one day to about ten days. Process at temperature of about 70 (about 21 **) to about 90 Fahrenheit (about 32 **), and the 2nd mixture is formed, By processing the 2nd mixture at sufficient temperature to inactivate culture and an enzyme in the 2nd mixture, and forming a cream butter flavor ingredient, it is prepared and a cheese-head Mr. taste component, Lipase, protease, and peptidase are used for the 3rd milk concentrate, Will process from about 0.5 day at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 3rd mixture will be formed, [about ten days and] It is prepared by processing the 3rd mixture at sufficient temperature to inactivate an enzyme

in the 3rd mixture, and forming a cheese-head taste component, A sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component of this cheese-head flavor system can be mixed with a cheese head or a dairy-products base in various quantity, and a cheese head which has various flavors can be manufactured.
[0020]The sharp Cheddar taste component or a concentrate can also be independently used, in order to substitute for a flavoring cheese head ripe in manufacture of process cheese again. Thus, this invention provides a method of generating the sharp Cheddar taste component or a concentrate for using in cheesemaking further. A flavor scent tone specific to natural cheese can be independently used for this sharp Cheddar taste component or concentrate, in order to provide with the sharp Cheddar scent tone addition, especially a very young cheddar cheese. Thus, provide this invention further and a sulfur Cheddar taste component for using it for flavoring of a cheese head this sulfur Cheddar taste component, A milk concentrate by lactic acid culture and option by stearolytic enzyme and high-protein decomposition activity culture. The 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH is formed, Add a sulfur content substrate into the 1st mixture, form the 2nd mixture, and the 2nd mixture Brevibacterium linens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacterium linens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, It is prepared by processing from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), forming the 3rd mixture, processing the 3rd mixture at sufficient temperature to inactivate an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component. [about ten days and]
[0021]In this method, a starting material is a milk concentrate containing aquosity protein and a fat content mixture. Generally this water milk origin concentrate (namely, milk system condensed highly) has about 10% from about 0.5% of a lactose content about 30% from about 15% of a fat content about 19% from about 10% of a protein content about 50% from about 30% of the total solid content. Preferably, this aquosity milk origin concentrate has about 5% from about 0.5% of a lactose content about 25% from about 18% of a fat content about 17% from about 12% of a protein content about 47% from about 35% of the total solid content. Preferably, this aquosity milk origin concentrate or substrate is a recombined milk substrate prepared from a mixture of a fluid milk concentrate prepared by an ultrafiltration/diafiltration (UF/DF) or UF/DF powdered milk, and milk fat. As shown in drawing 1, this fluid milk concentrate is divided into three portions next, and each is processed with a specific flavor enzyme, culture, an adjuvant, and other additive agents during sufficient predetermined period for making the specific flavor characteristic reveal (namely, fermentation). By using this method, a "sulfur Cheddar" ingredient, a "cream butter" ingredient, and a "cheese-head" ingredient are generable. Next, it heats to sufficient temperature to inactivate the enzyme /

culture system which used each portion in order to prepare a specific taste component, and holds at the temperature sufficient time. Generally, in order to mainly prepare three sorts of taste components [each of] of a cheese-head flavor system of this invention for convenience, it is preferred to use a same or similar milk concentration constituent, but if it is a request, in order to prepare three sorts of taste components [each of], a separate milk concentration constituent can be used.

[0022]After a heating inactivation stage, in order to provide a strong and flavored culture concentrate, three sorts of taste components or a substrate can be used independently, or can be set by two sorts or three sorts of groups. If it is a request, a sulfur Cheddar ingredient which has a strong sulfur scent tone can be independently used, in order to provide the sharp Ajika tone of the Cheddar style. However, preferably, in order to provide various flavoring cheese heads, this flavor system is various quantity and three sorts of all taste components are used for it. This taste component or concentrate can manufacture the cheese head / dairy-products powder which could use directly, or dried (for example, spray drying), and was flavored strongly.

[0023]This flavor concentrate or cheese-head powder can be used in order to prepare various flavoring cheese heads. Provide this invention further and a method of preparing a flavoring cheese head using a culture cheese-head concentrate said method, (1) Including mixing with a cheese-head base what a cheese-head base is prepared for, and about 1% of (2) to about 10% of culture cheese-head concentrate, and forming a flavoring cheese head this culture cheese-head concentrate, Including 0 to about 80% of sulfur Cheddar taste component, about 10 to about 90% of cream butter flavor ingredient, and about 10 to about 90% of cheese-head taste component, a sulfur Cheddar taste component, The 1st milk concentrate by lactic acid culture and option by stearolytic enzyme and high-protein decomposition activity culture. The 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH is obtained, Add a sulfur content substrate into the 1st mixture, form the 2nd mixture, and the 2nd mixture Brevibacteriumlinens culture, Using yeast of Debaromyces or Kluyeromyces group origin so that Brevibacteriumlinens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it From about three days to or about ten days. Process at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 3rd mixture is formed, By processing the 3rd mixture at sufficient temperature to inactivate culture and an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component, it is prepared and a cream butter flavor ingredient, Stearolytic enzyme is used for the 2nd milk concentrate by lactic acid culture and option, Process from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and the 4th mixture is formed, Add sodium acid citrate into the 4th mixture, form the 5th mixture, and the 5th mixture by diacetyl

generation flavor culture. For [from about one day] about ten days, process by about 90 Fahrenheit (about 32 **) from about 70 Fahrenheit (about 21 **), and the 6th mixture is formed, By processing the 6th mixture at sufficient temperature to inactivate culture and an enzyme in the 6th mixture, and forming a cream butter flavor ingredient, it is prepared and a cheese-head taste component, Will process the 3rd milk concentrate from about 0.5 day using lipase, protease, and peptidase at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 7th mixture will be formed, [about ten days and] It is prepared by processing the 7th mixture at sufficient temperature to inactivate an enzyme in the 7th mixture, and forming a cheese-head taste component, Quantity of a sulfur Cheddar taste component in a culture cheese-head concentrate, a cream butter flavor ingredient, and a cheese-head taste component and quantity of a culture cheese-head concentrate mixed with a cheese-head base can be adjusted in order to obtain a flavoring cheese head which has various flavors.

[0024]Provide this invention further and a method of preparing a flavoring cheese head using a culture cheese-head concentrate said method, (1) Mix [what a milk substrate suitable for manufacture of a cheese head is prepared for,] about 1% of (2) to about 10% of culture cheese-head concentrate with a milk substrate, (3) Process a milk substrate and a culture cheese-head concentrate, and solidify a milk substrate, (4) Cook cutting a coagulation milk substrate and forming a card and whey, (5) cards, and whey, (6) Including separating a card from whey, and forming a flavoring cheese head from a card which carried out (7) separation this culture cheese-head concentrate, Including 0 to about 80% of sulfur Cheddar taste component, about 10 to about 90% of cream butter flavor ingredient, and about 10 to about 90% of cheese-head taste component, a sulfur Cheddar taste component, The 1st milk concentrate by lactic acid culture and option by stearolytic enzyme and high-protein decomposition activity culture. Obtain the 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH, add a sulfur content substrate into the 1st mixture, and the 2nd mixture is formed, The 2nd mixture Brevibacteriumlinens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacteriumlinens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 3rd mixture will be formed, [about ten days and] By processing the 3rd mixture at sufficient temperature to inactivate culture and an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component, it is prepared and a cream butter flavor ingredient, Stearolytic enzyme is used for the 2nd milk concentrate by lactic acid culture and option, Process from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and the 4th mixture is formed, Add sodium acid citrate into the 4th mixture, and form the 5th mixture, and process the 5th mixture by about 90 Fahrenheit (about

32 **) by diacetyl generation flavor culture from about ten days from about one day, and about 70 Fahrenheit (about 21 **), and the 6th mixture is formed, By processing the 6th mixture at sufficient temperature to inactivate culture and an enzyme in the 6th mixture, and forming a cream butter flavor ingredient, it is prepared and a cheese-head taste component, Lipase, protease, and peptidase are used for the 3rd milk concentrate, Will process from about 0.5 day at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 7th mixture will be formed, [about ten days and] It is prepared by processing the 7th mixture at sufficient temperature to inactivate an enzyme in the 7th mixture, and forming a cheese-head taste component, Quantity of a sulfur Cheddar taste component in a culture cheese-head concentrate, a cream butter flavor ingredient, and a cheese-head taste component and quantity of a culture cheese-head concentrate mixed with a milk substrate can be adjusted in order to obtain a flavoring cheese head which has various flavors.

[0025]

[Embodiment of the Invention]In the method of this invention, a starting material is the milk concentrate or substrate of the gestalt of aquosity protein and a fat content mixture. As above-mentioned, in order to mainly prepare three sorts of taste components [each of] of a cheese-head flavor system of this invention for convenience generally, it is preferred to use a same or similar milk concentration constituent, but if it is a request, in order to prepare three sorts of taste components [each of], a separate milk concentration constituent can be used. Generally the milk origin concentrate of this aquosity or two or more concentrates (namely, milk system condensed highly) have about 10% from about 0.1% of a lactose content about 30% from about 15% of a fat content about 19% from about 10% of a protein content about 50% from about 30% of the total solid content. Preferably, this aquosity milk origin concentrate has about 5% from about 0.5% of a lactose content about 25% from about 18% of a fat content about 17% from about 12% of a protein content about 47% from about 35% of the total solid content. Generally the amount of hygroscopic surface moisture of this substrate is about 53% to about 65% preferably about 70% from about 50%. The protein source can be dry protein or concentration material, and are a dairy-products ingredient, for example, a milk protein concentrate, fractionation milk protein, a concentrated milk fat, whey protein concentrate, dry whey, powdered skim milk, or those mixtures preferably. The sources of a fat are milk fat, for example, anhydrous milk fat, butter, cream, or those mixtures preferably. Soybean protein, corn protein, wheat protein, rice protein, etc. can use other protein sources. Other sources of a non-dairy product fat, such as vegetable oil, can be used. pH of a milk concentrate or a substrate -- general -- about 6 to about 7 range -- it is about 6.5 to about 6.7 range preferably.

[0026]A dry protein source is returned with water, when using. Water is used in sufficient quantity for the total hygroscopic surface moisture in a substrate to be about 53 to about 65% from about 50% preferably about 70%. Together with the source of a fat, a substrate is

provided for this source of reduced protein. If required, edible acid can be added or pH of a substrate can be lowered to the suitable range (from about 4.8 to about 5.6 [From about 4.6 to about 6.0 / namely, / preferably]) using a lactic acid generation microorganism. Suitable edible acid is avirulent inorganic matter or organic acid, and chloride, acetic acid, maleic acid, tartaric acid, citrate, phosphoric acid, lactic acid, and those mixtures are contained. In preparation of a milk concentrate, if it is a request and/, or necessity in order to reduce fat drop particle diameter and to secure the homogeneity of a substrate, a homogenizer can be used.

[0027]Preferably this aquosity milk origin concentrate or substrate, It is the recombined milk substrate prepared from the mixture of the fluid milk concentrate prepared by the ultrafiltration (it is independent or put together as diafiltration still more preferably), an ultrafiltration (UF) or an ultrafiltration / powdered milk by which diafiltration (UF/DF) was carried out, and milk fat. It is UF/DF milk which has the characteristic of the following [starting material] preferably.

[0028]

[Table 1]

	典型量（%）	好ましい量（%）	より好ましい量（%）
総固形分	30-50	35-47	40
湿分	50-70	53-65	60
脂肪	15-30	18-25	21
タンパク質	10-19	12-17	14.5
ラクトース	0.1-10	0.5-5	1
塩	1-3	1-2	1-2
灰分	0.5-2.5	1-2	1-2
pH	6-7	6.5-6.7	6.6

[0029]A desirable starting material can be prepared from the pasteurization (from about 2% to about 15% [From 0% to about 20% preferably]) whole milk or skim milk which added cream. This milk substrate by a heat exchanger From about 110 Fahrenheit (about 43 **) to next, about 140 Fahrenheit (about 60 **). It heats to about 120 Fahrenheit (about 49 **) preferably, and after that, the usual ultrafiltration / diafiltration technique are presented, and about 8 times [about 3 to] (preferably about 5 times) as many milk concentration output is generated. For example, after heating for about 16 seconds by 168 Fahrenheit (about 76 **) and cooling from about 70 Fahrenheit (about 21 **) to about 80 Fahrenheit (about 27 **), this milk concentrate substrate can be used in order to prepare the specific taste component of this invention. In order to generate a specific taste component preferably, before processing with various enzymes / culture / additive agents, about 1 to about 2% of salt is added to a milk concentrate substrate. This milk concentrate is a fluid which is viscous in comparison, and contains about 35 to about 47% of solid content preferably.

[0030]As shown in drawing 1, the fluid milk concentrate which contains about 1 to about 2% of

salt preferably is divided into three portions next, and each is processed with a specific enzyme, culture, an adjuvant, and other additive agents during sufficient predetermined period for making the specific flavor characteristic reveal (namely, fermentation). A specific enzyme, culture, an adjuvant, and other additive agents are given, and a "sulfur Cheddar" ingredient, a "cream butter" ingredient, and a "cheese-head" ingredient can be generated from there. Although not shown in drawing 1, the uniformity stage of option can be presented with the flow of each ingredient in front of fermentation or in the back. After fermentation, each portion is heated to sufficient temperature to inactivate culture and an enzyme system, and is held to the temperature sufficient time.

[0031]After a heating inactivation stage, in order to provide the strong and flavored culture cheese-head concentrate, three sorts of taste components or a substrate can be used independently, or can be set by two sorts or three sorts of groups. Preferably, the culture cheese-head concentrate of this invention contains 0 to about 80% of sulfur Cheddar ingredient, about 10 to about 90% of cream butter ingredient, and about 10 to about 90% of cheese-head ingredient. The culture cheese-head concentrate of this invention contains about 25 to about 75% of sulfur Cheddar ingredient, about 25 to about 75% of cream butter ingredient, and about 25 to about 75% of cheese-head ingredient more preferably. This culture cheese-head concentrate can be a physical compound of an ingredient, and it is used in order to prepare the flavoring cheese head of a request of that compound next. As an exception method, this culture cheese-head concentrate can be formed by adding an ingredient separately to a cheese-head substrate. The constituent produced as a result is used in order to prepare a desired flavoring cheese head after that.

[0032]As illustrated in the Example 5, this flavor constitutional unit material (namely, three sorts of taste components) can be added to a milk substrate, and it is used in order to form a cheese head next. As illustrated in the Example 6 as an exception method, this flavor constitutional unit material can be added at the already prepared cheese-head base. The relative amount of the three-sort ingredient in a culture cheese-head concentrate and the total amount of a culture cheese-head concentrate mixed can be various in order to obtain the combination or flavor scent tone of specific flavor according to the desired flavor characteristic. Using three sorts of ingredients, and a cheese-head base, the cheese-head type across which it goes variably can be prepared so that it may illustrate to the following table 2.

[0033]

[Table 2]

本発明の培養チーズ濃縮物を用いて調製したチーズの例

チーズ		培養チーズ濃縮物（重量部）		
		硫黄チェダー	クリームバター	チーズ
プロセスチーズ		1.7	7	1.3
クリームチーズ		0	8	2
チェダー	ミディアム	1	6	3
	シャープ	3.3	3.3	3.3
	エクストラシャープ	6	1	3
モッツァレラ		0	7.5	2.5
パルメザン		1	3	6
ロマノ		1	1	8

[0034]Generally, the cheese head produced as a result contains about 2 to about 6% of culture cheese-head concentrate preferably about 10% from about 1%. The engineer of the field will understand that both various relative amounts and total amounts of an ingredient can be changed and/or optimized for the time being, in order to obtain a desired flavor profile especially, though natural. Three sorts of these ingredients can be used in order to obtain other flavoring cheese heads, and they can be used for various cheese-head bases (for example, process cheese, process cheese type foodstuffs, natural cheese, cream cheese, cottage cheese, etc.).

[0035]As it mentions above and was shown in drawing 1, this fluid milk concentrate is divided into three portions, and each is processed with a specific enzyme, culture, an adjuvant, and other additive agents during sufficient predetermined period for making the specific flavor characteristic reveal (namely, fermentation). A specific enzyme, culture, an adjuvant, and other additive agents are given, and a "sulfur Cheddar" ingredient, a "cream butter" ingredient, and a "cheese-head" ingredient can be generated from there. The process of preparing these ingredients does not need a whey effluent stage. Preparation of each taste component is indicated below.

[0036]Preparation of a sulfur Cheddar ingredient sulfur Cheddar ingredient is preferably carried out at two steps of processes shown in drawing 1. In the 1st phase, lactic acid culture is added to a milk substrate, it maintains from about 10 hours for about 24 hours by about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and about 5.4 or less pH is acquired. Preferably, stearolytic enzyme and high-protein decomposition activity culture, or protease is further added with lactic acid culture in the 1st step. Next, the Brevibacterium linens culture by which culture or yeast can convert a sulfur content substrate into the sulfur content flavor compound which is sensuously effective by it, Or yeast of Debaromyces or Kluyeromyces group origin and a sulfur

content substrate are added, and fermentation will be continued for ten days from about three more days at the temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **) (preferably about 72 Fahrenheit (about 22 **)). Preferably, in order to form a sulfur content compound, Brevibacterium linens culture is used. Between two fermentation stages, any enzyme / culture heating inactivation should not exist. An enzyme can be generated from various microorganisms or can be extracted from vegetation or an animal tissue. Various enzymes of this enzyme system are marketed in the shape of the end of dried powder, or a fluid. Preferably, both stages are carried out with a single container. Preferably, a reaction mixture is aerated during fermentation, in order to prevent non-gaseous state voice and to provide good mixing. Generally, conditions should be maintained so that phase separation under fermentation may be made into the minimum. When phase separation happens, arbitrary uniformity steps can be used after fermentation. After completing two fermentation steps or a stage, culture and an enzyme are inactivated for about 16 seconds to about 30 minutes by about 190 Fahrenheit (about 88 **) heating by about 155 Fahrenheit (about 68 **) for about 10 minutes preferably from about 145 Fahrenheit (about 63 **). In order to raise heat transfer preferably, a reaction mixture is recycled during inactivation.

[0037]In order to form a sulfur content compound as above-mentioned, Brevibacterium linens culture is used preferably. If it is a request, the microorganism which denaturalized genetically so that the activity of Brevibacterium linens resemblance might be provided can be used instead of Brevibacterium linens culture. The purpose of this invention is considered that such a microorganism that denaturalized genetically is included by the term of "Brevibacterium linens culture."

[0038]They are tripeptide in which a "sulfur content substrate" contains a sulfur content free amino acid and sulfur content amino acid about the purpose of this invention, and a protein hydrolyzate containing sulfur content amino acid. the foodstuffs protein hydrolyzate for which it was suitable -- Quest International (Illinois.) It is a trade name of N-Z-Amine from Hoffman Estates, N-Z-Case, Hy-Case, and Pepticase, and can obtain from other manufacturers. Preferably, L-methionine, L-glutathione, and L-cysteine are contained in a sulfur content substrate. In an especially desirable embodiment, a sulfur content substrate is a mixture of the mixture of the mixture of L-methionine and L-glutathione, L-methionine, and L-cysteine or L-methionine, L-glutathione, and L-cysteine. Generally a sulfur content substrate is added in about 0.01 to about 1% of quantity.

[0039]In a desirable embodiment, especially a sulfur Cheddar ingredient, A milk concentrate (from pH about 6.0 to about 6.7) in the 1st step Lactic acid culture, By stearolytic enzyme and high-protein decomposition activity culture, process and After that, . Added L-methionine and L-glutathione, without inactivating. Or it is prepared by having added L-methionine and L-cysteine, or processing further by the Brevibacterium linens culture which added L-methionine,

L-glutathione, and L-cysteine. This 1st step is carried out from about 10 hours for about 24 hours at the temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **). The 2nd step will be preferably carried out for [from about four days] about eight days for ten days from about one day at the temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **). As for two stages, as shown in drawing 1, it is preferred to carry out sequentially, but it can also collect into a single fermentation stage. Generally the fermentation process of such a single stage is carried out by about 86 Fahrenheit (about 30 **) from about 65 Fahrenheit (about 18 **) for [from about three days] about ten days.

[0040]The especially desirable presentation for preparing a sulfur Cheddar ingredient is indicated to the following table 3. Example 1 illustrates preparation of a sulfur Cheddar ingredient using the ingredient and the "amount of types" which were mentioned to Table 3.

[0041]

[Table 3]

硫黄チェダー成分を調製するための特に好ましい組成

成分	範囲(%)	典型量(%)	機能
5倍UF／DF乳	バランス	98.78	乳基質
第1段階			
前胃エステーゼ	0-1	0.02	脂肪を遊離脂肪酸に加水分解するための脂肪分解酵素
Lactococcus lactis、および Lactococcus lactis 亜種 cremoris	0.001-2	0.01	ラクトースを乳酸に転換し、pHを下げるためのスターターカルチャー
Micrococcus	0.0001-1	0.001	カゼインをペプチドに転換する高タンパク質分解活性を備えた風味補助剤培養菌
第2段階			
Brevibacterium linens	0.001-2	0.01	硫黄風味化合物を生成するための風味補助剤培養菌
L-メチオニン	0.01-1	0.1	硫黄化合物生成のためのアミノ酸基質
L-グルタチオン	0.01-1	0.1	トリペプチド基質および風味発現のための酸化還元平衡状態を作る処理助剤、遊離アミノ酸に加水分解

[0042]Generally other sulfur content substrates exist in about 0.01 to about 1% of quantity, when using. Fermentation is carried out in the state of aeration, in order to prevent a reaction mixture serving as non-mind preferably and to provide good mixing. Preferably, it aerates by introducing air into a reaction mixture using a diffusion plate or an in-series air sparger. if suitable, when phase separation happens namely,, a reaction mixture can be uniformed in

advance of the further processing by option. Culture and an enzyme are inactivated for about 16 seconds to about 30 minutes after fermentation by heating by about 185 Fahrenheit (about 85 **) from about 150 Fahrenheit (about 66 **). Preferably, aeration stops between heating inactivation processes.

[0043]This sulfur content substrate is added in order to help generation of a sulfur compound important for the manifestation of the Cheddar flavor, especially the sharp Cheddar flavor. L-methionine, L-glutathione, L-cysteine, and those mixtures are contained in a desirable sulfur content substrate. Since a sulfur compound is produced by operation of Brevibacterium linens culture or yeast (preferably Brevibacterium linens), L-methionine is used. This tripeptide L-glutathione (namely, glutamine cystein glycine) and amino acid L-cysteine, In addition to working as a substrate, it acts also as a processing auxiliary agent which makes the oxidation reduction equilibrium situation which promotes flavor generation by producing a desired sulfur flavor compound (namely, methanethiol, dimethyl disulfide, and dimethyl trisulfide). The hydrolysis to the free amino acid of L-glutathione by microbial enzymes is expected during a fermentation period. The further hydrolysis may take place during the next heat-treatment (namely, under inactivation and/or the mixture to a cheese-head base). Generally, the quantity of L-glutathione expected from the last cheese product (namely, flavoring cheese product manufactured using the cheese-head flavor system of this invention) is less than about 10 ppm.

[0044]The generated sulfur Cheddar ingredient which is produced as a result is the fluid or paste which has a hygroscopic-surface-moisture content of about 53 to about 65% of range preferably about 70% from about 50% typically. Without not adding supporting materials, such as a whey concentrate or malto dextrin, or adding them, spray drying of this sulfur Cheddar ingredient can be carried out, and it can provide powder. Generally this sulfur Cheddar ingredient has the flavor characteristic / profile of the following shown in Table 4. They are not detected although it seems that this sulfur Cheddar ingredient contains other effective aroma or flavor compounds containing a sulfur content compound.

[0045]

[Table 4]

硫黄チェダー成分の典型的な風味プロファイル

	範囲	典型量
メタンチオール*	700-15M	3.7M
二硫化ジメチル*	1M-50M	9.7M
三硫化ジメチル*	1M-50M	6.9M
酢酸	500-1500 ppm	916 ppm
プロピオン酸	<25-100 ppm	<25 ppm
酪酸	100-500 ppm	285 ppm
ヘキサン酸	10-200 ppm	92 ppm
オクタン酸	10-200 ppm	45 ppm
デカン酸	10-200 ppm	64 ppm
ドデカン酸	10-200 ppm	82 ppm

[0046]* A sulfur compound is reported by the peak value area determined using the gas chromatography. M= million. The initial peak value area of these sulfur compounds was 0 intrinsically.

[0047]Preparation of a cream butter ingredient cream butter ingredient is preferably carried out at two steps of processes shown in drawing 1. Preparation of a cream butter ingredient adds lactic acid culture to a milk concentrate, and then carries out the mixture from about 10 hours by fermenting in about 86 Fahrenheit (about 30 **) from about 70 Fahrenheit (about 21 **) for about 24 hours. Preferably, stearolytic enzyme is further added to a milk concentrate with lactic acid culture. Next, diacetyl generation flavor culture and sodium acid citrate are added, and about 90 Fahrenheit (about 32 **) continues fermentation by about 82 Fahrenheit (about 28 **) preferably from about 70 Fahrenheit (about 21 **) for [from about five days] about eight days for [from about one day] about ten days. An enzyme can be generated from various microorganisms or can be extracted from vegetation or an animal tissue. Various enzymes of this enzyme system are marketed in the shape of the end of dried powder, or a fluid. Preferably, a reaction mixture is aerated during fermentation, in order to prevent non-gaseous state voice and to provide good mixing. Phase separation is not a remarkable problem under fermentation. After a fermentation step is completed, culture and an enzyme are inactivated for about 16 seconds to about 30 minutes by heating from about 145 Fahrenheit (about 63 **) for about 10 minutes preferably to about 190 Fahrenheit (about 88 **) at about 155 Fahrenheit (about 68 **).

[0048]In a desirable embodiment, especially a cream butter ingredient, A milk concentrate (from pH about 6.0 to about 6.7) in the 1st step Lactic acid culture, And without processing by rumina esterase, next inactivating, sodium acid citrate is added (from about 0.05% to about 5% [Generally]), and it is prepared by processing by one sort or two or more culture which can generate diacetyl from citrate further. Leuconostoc and the Lactococcus lactis subspecies

lactis biovar diacetylactis are contained in desirable diacetyl generation culture. This 1st-step fermentation is carried out from about 10 hours for about 24 hours at the temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **). The 2nd step will be carried out for about ten days from about one day at the temperature of about 70 (about 21 **) to 90 Fahrenheit (about 32 **). As for two stages, as shown in drawing 1, it is preferred to carry out sequentially, but it can also collect into a single fermentation stage. Generally the fermentation process of such a single stage will be carried out for about ten days from about one day at the temperature of about 70 (about 21 **) to 90 Fahrenheit (about 32 **).

[0049]Leuconostoc and Lactococcus lactis subspecies lactis biovar diacetylactis culture are desirable diacetyl generation flavor culture as above-mentioned. If it is a request, the microorganism which denaturalized genetically so that similar activity might be provided can be used instead of Leuconostoc and/or Lactococcus lactis subspecies lactis biovar diacetylactis culture. The purpose of this invention is considered that such a microorganism that denaturalized genetically is included by the term of "diacetyl generation flavor culture."

[0050]The especially desirable presentation for preparing a cream butter ingredient is indicated to the following table 5. Example 2 illustrates preparation of a cream butter ingredient using the ingredient and the "amount of types" which were mentioned to Table 5.

[0051]

[Table 5]

クリームバター成分を調製するための特に好ましい組成

成分	範囲（%）	典型量（%）	機能
5倍 UF/DF 乳	バランス	89.83	乳基質
第1段階			
前胃ｴｽﾃﾗｰｾﾞ	0-1	0.02	脂肪を遊離脂肪酸に加水分解する脂肪分解酵素
Lactococcus lactis、および Lactococcus lactis 亜種 cremoris	0.001-2	0.01	ラクトースを乳酸に転換し、ｐＨを下げるためのスターターカルチャー
第2段階			
ｸｴﾝ酸ﾅﾄﾘｳﾑ	0.01-10	0.3	ジアセチル生成、および風味発生の基質
Leuconostoc	0-1	0.0001	クエン酸塩からジアセチルを生成するための風味補助剤培養菌
Lactococcus lactis 亜種 lactis 次亜種 diacetylactis	0-1	0.0001	クエン酸塩からジアセチルを生成するための風味補助剤培養菌

[0052]After fermentation, culture and enzymes are about 190 Fahrenheit (about 88 **) from about 145 Fahrenheit (about 63 **) for about 16 seconds to about 30 minutes, and are preferably inactivated by heating by about 155 Fahrenheit (about 68 **) for about 10 minutes.

Preferably, aeration is not used after heating inactivation in process or a process.
[0053]The generated cream butter ingredient which is produced as a result is the fluid or paste which has a hygroscopic-surface-moisture content of about 53 to about 65% of range preferably about 70% from about 50% typically. Without not adding supporting materials, such as a whey concentrate or malto dextrin, or adding them, spray drying of this cream butter ingredient can be carried out, and it can provide powder. Generally this cream butter ingredient has the flavor characteristic / profile shown in Table 6. It seems that it is not detected and that this cream butter ingredient contains other aroma or flavor compounds which have effect.
[0054]
[Table 6]
クリームバター成分の典型的な風味プロファイル

	範囲（ｐｐｍ）	典型量（ｐｐｍ）
エタノール	1-150	41
アセトン	1-5	2
ジアセチル	20-400	173
酢酸	400-1000	860
プロピオン酸	<25-100	<25
酪酸	200-500	275
ヘキサン酸	20－150	86
オクタン酸	10-100	30
デカン酸	50-150	86
ドデカン酸	50-150	103

[0055]A cheese-head ingredient cheese-head ingredient can be prepared using the starting material and procedure which were generally indicated to simultaneous pendency U.S. patent application 09th of the August 27, 1998 application made into the part of this specification by reference / No. 141082. Lipase, protease, and peptidase are contained in the enzyme system used in order to prepare this cheese-head ingredient. A substrate will be preferably processed by this enzyme system for about three days from about one day at the temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and a desired cheese-head flavor level will be made to reach for [from about 0.5 day] about ten days. An enzyme can be generated from various microorganisms or can be extracted from vegetation or an animal tissue. Various enzymes of this enzyme system are marketed in the shape of the end of dried powder, or a fluid.
[0056]Lipase (called esterase) is an enzyme known well for the time being in the fields. Lipase is typically obtained from the throat tissue of a young animal (the calf, a kid goat, or a lamb), the pancreas of a mature animal, or the source of a microorganism. Dispensing of various marketing obtained from the throat organization can be obtained from SKW BioIndustries, Marschall Laboratory, or such other companies with various trade names. This enzyme is generable by grinding an edible throat with a salt and powdered skim milk, drying that mixture

and grinding again. The source of a microorganism of lipase, for example Candida cylindraceaTypeVIII of mold, They are Aspergilus oryzae, A.niger, Pencillium roqueforti, P.glaucum, and Phizopus oryzae.

[0057]Generally in preparation of a cheese-head ingredient, powder lipase (preferably bacillus lipase) is used in about 0.05 to about 0.4% of quantity. Suitable bacillus lipase is a trade name of Lipomod 187, and is marketed from Biocatalysts.

[0058]Protease is an enzyme which can be obtained from a bacillus, vegetation, or the source of an animal and which is known well for the time being in the fields. Biocatalyst to available Enzeco NeutralBacterialProtease 2X and available Promod 215 are contained in the example of the protease for which it was suitable from Enzyme Development Corp. Generally, powder protease is about 0.01 to about 1% of quantity, and is preferably used in 0.1 to about 0.4% of quantity.

[0059]Peptidase activity and the enzyme which has aminopeptidase activity preferably are used in this enzyme system, and such an enzyme acts on the bitter peptides produced from proteolysis. Peptidase enzyme produces the high-concentration free amino acid and small peptide which are contributed to cheese-head flavor in collaboration with protease enzyme. This peptidase can be refining enzyme material, or Lactobacillus helveticus etc. can be the cells of the microorganism which produces peptidase activity. This cultured cell can be spray drying, freeze-drying, freezing, or a newly cultured cell, and un-growing up or growth can be possible for it in a substrate. A spray drying Lactobacillus helveticus cell is preferably used in about 0.05 to about 0.30% of quantity about 3% from about 0.01%. A desirable enzyme is powder. However, probably, the suitable fluid shape of these enzymes is permitted by use by this invention.

[0060]A substrate will be preferably processed by this enzyme system for about three days from about one day, and a desired cheese-head flavor level will be made to reach for [from about 0.5 day] about ten days. This processing is carried out at the temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **). A desired flavor level can be judged sensuously and can presume the concentration of pH, titratable acidity, free fatty acid, and amino acid, etc. by analytical measurement. If target flavor is reached, a mixture will be heated to the temperature of about 160 (about 71 **) to about 210 Fahrenheit (about 99 **), and an enzyme will be inactivated by holding a substrate to the high temperature sufficient time (from about 5 minutes to for example, about 60 minutes) to make inactivation of a perfect enzyme into a positive thing.

[0061]In order to provide a desired flavor profile, the enzyme can add all simultaneously sequentially. In addition of a successive enzyme, one sort or two or more enzymes are added, and the processing term for about five days is carried out from about 4 hours. Then, the remaining enzymes are added and the further predetermined period and processing will be

continued from about 0.5 day for about five days. An inactivation step does not exist between successive additions of an enzyme.

[0062]In other embodiments of this invention, the 1st enzyme treatment is performed by the relatively high temperature of about 120 (about 49 **) to about 140 Fahrenheit (about 60 **). At least one sort of enzymes are added, and it incubates at about 2 to about 6 hours of the 1st processing, and this temperature. Next, the remaining enzymes are added at the 2nd processing term for about ten days from about 6 hours carried out at the temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **).

[0063]This process can be carried out with a single container, without moving to another container for a successive stage, and is performed such preferably. The container is preferentially provided with the mixed device, in order to secure the good contact between an enzyme and substrate material and to maintain the solid content in suspension. A scrape DOSA face mixing tank is preferred. In order to prevent separation from the aquosity material of a fat phase and to help maintenance of the solid content in suspension, recycle and a homogenizer can be used. In order to maintain a desired hygroscopic-surface-moisture content, water can be added during fermentation, and in order to adjust pH, acidity or a basic material can be added.

[0064]Especially, in a desirable embodiment, as shown in drawing 1, a cheese-head ingredient, The milk concentrate (from pH about 6.0 to about 6.7) which added phosphoric acid 1 sodium with the enzyme and bacillus protease which have neutral bacterial protease and aminopeptidase activity, and bacillus lipase. It is prepared for about two days by processing at the temperature of about 100 (about 38 **) to about 110 Fahrenheit (about 43 **).

[0065]The especially desirable presentation for preparing a cheese-head ingredient is indicated to the following table 7. Example 3 illustrates preparation of a cheese-head ingredient using the ingredient and the "amount of types" which were mentioned to Table 7.

[0066]

[Table 7]

チーズ成分を調製するための特に好ましい組成

成分	範囲（%）	典型量（%）	機能
5倍 UF/DF 乳	バランス	98.2	乳基質
ﾘﾝ酸一ﾅﾄﾘｳﾑ	0.1-3	1.0	懸濁液中の固形分の維持を助ける乳化剤
中性細菌ﾌﾟﾛﾃｱｰｾﾞ（Enzeco Neutral Bacterial Protease 2X, Enzyme Development Corp）	0.01-1	0.15	風味生成のために、乳タンパク質をポリペプチド、ペプチド、アミノ酸に加水分解する中性細菌プロテアーゼ
Lactobacillus helveticus（EnzoBact、Medipharm）	0.01-3	0.14	脱苦味剤、アミノペプチダーゼ活性
菌ﾌﾟﾛﾃｱｰｾﾞ（Promod 215、Biocatalysts）	0.01-1	0.28	風味生成のために、乳タンパク質をポリペプチド、ペプチド、アミノ酸に加水分解するタンパク質分解酵素
菌ﾘﾊﾟｰｾﾞ（Lapomod 187、Biocatalysts）	0.01-1	0.12	脂肪を遊離脂肪酸に加水分解し、脂肪分解風味香調を発現するリパーゼ酵素
ソルビン酸	0.01-0.5	0.1	カビ阻害剤

[0067]In order to prevent a reaction mixture serving as non-mind preferably and to provide good mixing, fermentation is carried out where a shearing pump is used and recycled. An enzyme is inactivated after fermentation by applying heat (generally for [about 185 Fahrenheit (about 85 **)] about 30 minutes). Preferably, between heating inactivation processes, although the recirculation is continued, a shearing pump is not used. The desirable cheese-head ingredient prepared using the ingredient of an above-mentioned table has the improved flavor characteristic (namely, "sharp taste" of a stronger cheese head) compared with the similar ingredient generally prepared using the specific starting material and procedure which were indicated to simultaneous pendency U.S. patent application 09th / No. 141082.

[0068]The generated cheese-head ingredient which is produced as a result is the fluid or paste which has a hygroscopic-surface-moisture content of about 53 to about 65% of range preferably about 70% from about 50% typically. Without not adding supporting materials, such as a whey concentrate or malto dextrin, or adding them, spray drying of this cheese-head ingredient can be carried out, and it can provide powder. Generally this cheese-head ingredient has the flavor characteristic / profile shown in Table 8. It seems that it is not detected and that this cheese-head ingredient contains other aroma or flavor compounds which have effect.

[0069]

[Table 8]

チーズ成分の典型的な風味プロファイル

	範囲	典型量
ゲルプロファイル	9-34 k (100%)	9-11 k (100%)
プロテアーゼ活性	4-25 FL強度 単位/分/g	9.66 FL強度 単位/分/g
酢酸	10-100 ppm	35 ppm
プロピオン酸	<25 ppm-100	<100 ppm
酪酸	2000-7000 ppm	5823 ppm
ヘキサン酸	1000-5000 ppm	3254 ppm
オクタン酸	1000-4000 ppm	2922 ppm
デカン酸	4000-10000 ppm	5230 ppm
ドデカン酸	4000-10000 ppm	7145 ppm

[0070]Although the following examples illustrate the various features of this invention further, they do not limit the range of this invention stated to the attached claim in any points. As long as there are no special directions, all the percents and ratios are based on weight. Let all the references that made reference on these specifications be the parts of this specification by reference.

[0071]Example 1 this example illustrates preparation of a sulfur Cheddar ingredient. It doubled with fresh cream in sufficient quantity to obtain the standardization milk which has about 54% of fat content for fresh whole milk based on a dry substance. This standardization milk was pasteurized at low temperature by 164 Fahrenheit (about 73 **) for 16 seconds by the high-temperature-heat exchanger (HTST), and it cooled to 130 Fahrenheit (about 54 **) after that. Next, the cooled milk was condensed 5 times by the swirl type ultrafiltration (UF) system provided with diafiltration (DF), and the lactose content was reduced to about 1%. The UF/DF milk (about 1915 kg (4222 pounds)) which added 2% of salt was heat-treated by 155 Fahrenheit (about 68 **) for 10 minutes by the stirring jacketed vessel, and it cooled to 78 Fahrenheit (about 26 **) after that. This milk concentrate contained 41.8% of solid content, 22.6% of a fat, and 15.4% of protein, and had pH 6.4.

[0072]Lactic acid starter culture (0.01%) [Lactococcus lactis and] And Lactococcus lactis subspecies cremoris, R603, Micrococcus (0.001%), and rumina esterase (0.02%) of Chr.Hansens Inc. were added to the milk concentrate, it fermented in 75 Fahrenheit (about 24 **) in the 1st step for 17 hours, and pH amounted to 5.16. L-methionine (0.1%), L-glutathione (0.1%), and the activation culture (1%) of Brevibacterium linens were added to the 1st-step fermentation output, and the 2nd step of the fermentation process was started. Before use, under the aerobic condition, Brevibacterium linens culture is 75 Fahrenheit (about 24 **), and was activated in trypsin soybean culture medium (TSB) for 48 hours. The 2nd-step fermentation was continued in the state of aeration for seven more days at the temperature of 72 Fahrenheit (about 22 **). pH at the time of the 2nd-step end was 6.75. The quantity of the sulfur compound (namely, methanethiol, dimethyl disulfide, and dimethyl trisulfide) increased dramatically among the fermentation process (see the result of Table 4). In order to inactivate

culture and an enzyme for the sulfur Cheddar ingredient produced as a result and to prolong the storage life of a product, it heated to 155 Fahrenheit (about 68 **) for 10 minutes. The loss of the comparatively small sulfur compound was accepted in this inactivation step. The flavor profile of the sulfur Cheddar ingredient produced as a result is indicated in the paragraph of "the amount of types" in the above-mentioned table 4. This sulfur Cheddar ingredient had about 41% of the total solid content, and when it was a request, spray drying of it was able to be carried out and it was able to form sulfur Cheddar flavor powder.

[0073]Example 2 this example illustrates preparation of a cream butter ingredient. The milk concentrate similar to what was prepared in Example 1 was used as a start substrate.

[0074]Lactic acid starter culture (0.01%) [Lactococcus lactis and] And R603 of Lactococcus lactis subspecies cremoris and Chr.Hansens Inc. and rumina esterase (0.02%) were added to the milk concentrate, it fermented in 75 Fahrenheit (about 24 **) in the 1st step for 17 hours, and pH amounted to 5.16. Sodium acid citrate after heating to 82 Fahrenheit (about 28 **) (0.2%), And Leuconostoc (0.1%) and the activation culture of the Lactococcus lactis subspecies lactis biovar diacetylactic (0.1%) were added to the 1st-step fermentation output, and the 2nd step of the fermentation process was started. Before use, Leuconostoc and Lactococcus lactis subspecies lactis biovar diacetylactic culture are 75 Fahrenheit (about 24 **), and were activated in MRS culture medium overnight. The 2nd-step fermentation was continued in the state of aeration for six more days at the temperature of 82 Fahrenheit (about 28 **). pH at the time of the 2nd-step end was 5.26. The quantity of diacetyl rose to about 176 ppm from about 1 ppm of an initial value to the time of the 2nd-step end. In order to inactivate culture and an enzyme for the cream butter ingredient produced as a result and to prolong the storage life of a product, it heated to 155 Fahrenheit (about 68 **) for 10 minutes. The loss of comparatively small diacetyl was accepted in this inactivation step. The flavor profile of the cream butter ingredient produced as a result is indicated in the paragraph of "the amount of types" in the above-mentioned table 6. This cream butter ingredient had about 42% of the total solid content, and when it was a request, spray drying of it was able to be carried out and it was able to form cream butter flavor powder.

[0075]Example 3 this example illustrates preparation of a cheese-head ingredient. The milk concentrate was prepared using milk protein concentration (MPC) powder, water, anhydrous milk fat, and a salt.

[0076]MPC powder and a salt were hydrated using warm water by the VacuumCam Injection mixer, and the protein slurry was formed. The protein slurry was moved to the stirring jacketed vessel which carried out continuation recycle using the shearing pump. Next, the fused anhydrous milk fat was added and the milk concentrate was formed. The milk concentrate produced as a result contained 43.5% of solid content, 18.6% of fat, 13.7% of protein, and lactose 2.8%, and 1.85% of a salt.

[0077]Among the fermentation process, the milk concentrate was maintained to the same stirring jacketed vessel, where continuation recycle is carried out using a shearing pump. Phosphoric acid 1 sodium (0.5%) was added, and the slurry was heated by 162 Fahrenheit (about 72 **) for 15 minutes. Neutral bacterial protease after cooling to 104 Fahrenheit (about 40 **) (about 0.18%) Enzeco Neutral Bacterial Protease 2X, Enzyme Development Corp., Lactobacillus helveticus (about 0.14%) EnzoBact, Medipharm, bacillus protease (about 0.28% and Promod 215, Biocatalysts), and the enzyme slurry containing bacillus lipase (about 0.28% and Lipomod 187, Biocatalysts) were added. Percent is based on the gross weight of a fermentative mixture. Where it used the shearing pump and continuation stirring and the recirculation are carried out, it continued, in order to maintain an emulsion, and fermentation was continued by 104 Fahrenheit (about 40 **) for 48 hours. After completing fermentation, the enzyme was inactivated by heating to about 185 Fahrenheit (about 85 **) for 30 minutes. During inactivation, although aeration was continued, the shearing pump was not used. The flavor profile of the cheese-head ingredient produced as a result is indicated in the paragraph of "the amount of types" in the above-mentioned table 8. Next, sorbic acid (about 0.1%) was added. This cheese-head ingredient had about 43% of the total solid content, and when it was a request, spray drying of it was able to be carried out and it was able to form cheese-head flavor powder.

[0078]About 15.4 kg (34 pounds) (3.5% of butterfat) of example 4 milk and 0.75 ml of ANATO colorant of double intensity were added to the small cheese vat at the temperature of 88 Fahrenheit (about 31 **). The freezing pellet type starter culture (2.45 g, Chr.Hansens Inc.) was added, and this mixture was ripened for 30 minutes. Flavor constitutional unit material (namely, sulfur Cheddar, the cream butter, the cheese-head ingredient which were generated in Examples 1, 2, and 3, respectively the ratio of 1:1:1, the total amount of 30g) was mixed for aging milk. Next, it was made to solidify for 30 minutes, without adding rennet (1.7 ml, Chymax Extra, Chr.Hansens Inc.), and stirring the produced mixture. Next, the coagulation card was cut on about 0.95 cm (3/8 inch) cube, and was settled for 15 minutes. The card was stirred calmly by hand, applying for 30 minutes and raising temperature to 102 Fahrenheit (about 39 **) after a quiescent period. The card was cooked by 102 Fahrenheit (about 39 **) for 1 hour, and the effluent of the whey was carried out from the card in this time. The solid lump was made to unite a card and it was reversed every 15 minutes for 90 minutes. The small slab produced as a result was milled to an about 1.27x1.27x5.08 cm (1/2x1 / 2x2 inches) wafer. The interval of 5 minutes was kept between each addition, and the salt was added 3 times (12.9g / addition). The produced salting card was put into the small cheese hoop, and was pressurized overnight. After application of pressure, the cheese head was put into the vacuum chamber and pressurized for further 1 hour. The cheese head pressurized thoroughly carried out vacuum enclosure to evaluation at the plastic. It is the same method about a contrast cheese head,

however prepared, without including flavor constitutional unit material. The cheese head prepared using flavor constitutional unit material provided good flavor and sensuous characteristic.

[0079]About 15.4 kg (34 pounds) (3.5% of butterfat) of example 5 milk and 0.75 ml of ANATO colorant of double intensity were added to the small cheese vat at the temperature of 88 Fahrenheit (about 31 **). The freezing pellet type starter culture (2.45 g, Chr.Hansens Inc.) was added, and this mixture was ripened for 30 minutes. Next, it was made to solidify for 30 minutes, without adding rennet (1.7 ml, Chymax Extra, Chr.HansensInc.), and stirring the produced mixture. Next, the coagulation card was cut on about 0.95 cm (3/8 inch) cube, and was settled for 15 minutes. The card was stirred calmly by hand, applying for 30 minutes and raising temperature to 102 Fahrenheit (about 39 **) after a quiescent period. The card was cooked by 102 Fahrenheit (about 39 **) for 1 hour, and the effluent of the whey was carried out from the card in this time. The solid lump was made to unite a card and it was reversed every 15 minutes for 90 minutes. The small slab produced as a result was milled to an about 1.27x1.27x5.08 cm (1/2x1 / 2x2 inches) wafer. A freeze-dried flavor constitutional unit material (namely, sulfur Cheddar, the cream butter, the cheese-head ingredient which were generated in Examples 1, 2, and 3, respectively the ratio of 1:1:1, the total amount of 30g) was mixed with 38.9 g of salts, and it divided into three portions after that. The interval of 5 minutes was kept between each addition, and the mixture of constitutional unit material and a salt was added 3 times (22.9g / addition). The produced salting card was put into the small cheese hoop, and was pressurized overnight. After application of pressure, the cheese head was put into the vacuum chamber and pressurized for further 1 hour. The cheese head pressurized thoroughly carried out vacuum enclosure to evaluation at the plastic. It is the same method about a contrast cheese head, however prepared, without including flavor constitutional unit material. The cheese head prepared using flavor constitutional unit material provided good flavor and sensuous characteristic.

[0080]The lump of the pasteurization process cheese spread which has the sharp Ajika tone of the Cheddar style was prepared using the sulfur Cheddar taste component prepared in example 6 Example 1, the cream butter flavor ingredient prepared in Example 2, and the cheese-head taste component prepared in Example 3. About 1% of the sulfur Cheddar taste component, about 4% of the cream butter flavor ingredient, and about 1% of the cheese-head ingredient were added into the mixture of the young cheese head and the mild cheese head. Next, other ingredients were added in the following quantity.

[0081]whey powder <1% milk protein concentrate [ ] -- < -- 1% sorbic acid <0.5% cheese-head colorant <0.5% phosphoric acid 1 sodium and phosphoric acid disodium [ ] -3% [0082]The cheese-head mixture produced as a result was processed by 175 Fahrenheit (about 79 **) by the Damrow lei down open steam introduction cooker (Damrow Co.Inc., the Wisconsin fondu

rack). The cheese head which carried out heat melting was fabricated in about 0.9 kg (2 pounds) lump, and it cooled to 40 Fahrenheit (about 4 **) with the air-cooling-with-blower machine. The lump of the obtained pasteurization process cheese spread had flavor similar to the preparation cheese products made using the aging cheddar cheese, textures, and melting nature.

[Translation done.]

TECHNICAL FIELD

[Field of the Invention]This invention relates to the natural living thing generation cheese-head flavor system which can be used in order to prepare a very much different cheese head which generally has a desired flavor profile. This invention relates to details more at the natural living thing generation cheese-head flavor system containing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component. Each of these taste components can be used as a flavor constitutional unit provided with a respectively specific flavor profile and/or the flavor characteristic. By using combination with these various taste components, the cheese head which has various flavors can be manufactured easily. These taste components are independently prepared from the milk substrate condensed highly using the ingredient (for example, a specific enzyme, culture, and an additive agent) and process condition which were designed provide the taste component which has a specific flavor profile and/or the flavor characteristic. These taste components can be used for process cheese, natural cheese, or other cheese heads in order to manufacture a very much different cheese head provided with the desired flavor profile. This flavor concentrate can also be used for other foodstuffs as a natural flavor system.

[Translation done.]

PRIOR ART

[Description of the Prior Art]Generally, natural cheese makes milk reveal acidity and is made solidifying milk with coagulants, such as rennet, or by making acidity reveal till a proteinic isoelectric point. This coagulation milk is cut and whey is separated from the card to produce. A card can be pressurized and a cheese block can be provided. Hardening is typically performed over very long time under a control condition. for example, a cheddar cheese exceeds one year, in order to harden for at least four months and to obtain flavor with a sufficient request for a cheddar cheese -- period hardening may be carried out.
[0003]It is well known by grinding natural cheese and heating with an emulsification salt that the product which has some characteristics of natural cheese is provided. The name conferred upon the product produced as a result is decided by the used ingredient and its presentation, and is determined by the control criteria released to the U.S. Food and Drug Administration 21CFR133 paragraphs 169-180 depending on the case. For example, depending on an emulsification salt and the case, acid is added an emulsifier and usually, and the term of "pasteurization process cheese" points out the product containing the cheese-head compound which was processed into a plastic material homogeneous next and heated. The flavor of process cheese depends for the natural cheese (it super-riped for four months) held for a long period of time on using at a high rate. Use of the cheese head held for a long period of time increases the cost of process cheese for storage and an inventory carrying cost. The yield of the natural cheese manufactured by the usual method is comparatively low, generally about 45.36 kg (100 pounds) of milk hits, and about 4.54-5.44 kg (about 10-12 pounds) of cheese heads are manufactured. This also increases cost.
[0004]The term of "pasteurization process cheese foodstuffs" points out the product prepared from the same material as being used for manufacture of process cheese, and the same method. However, generally dairy-products ingredients, such as cream, milk, skim milk, whey, or a thing (for example, concentration skim milk) that removed some water from those either,

are added by such cheese food. Generally the amount of hygroscopic surface moisture of process cheese foodstuffs can be higher than process cheese, and can be to about 44%. Generally a fat exists in not less than 23% of quantity.

[0005]In the point that the shown dairy-products ingredient can be contained, the term of a "pasteurization process cheese spread" points out a product similar to cheese food. However, the process cheese spread can have about 60% of the high amount of hygroscopic surface moisture, and 20% of the minimum fat amount.

[0006]Since those manufacturing methods and presentations are determined by Federal Standards of Identity, process cheese, process cheese foodstuffs, and a process cheese spread are called a "standardized product."

[0007]In this specification, it is known by the term of "process cheese type products" as "pasteurization process cheese", "pasteurization process cheese foodstuffs", a "pasteurization process cheese spread", and "pasteurization process cheese products", and the product called such is contained in it. Although "process cheese type products" is similar to process cheese, process cheese foodstuffs, a process cheese spread, and process cheese products further, In the point that the ingredient which is not specified as U.S. Federal Standards of Identity is contained, or vegetable oil or vegetable protein may not satisfy the requirements for a presentation of such a standard, The product which may not meet the standard about one of above-mentioned products is included. It is not concerned with whether for process cheese type products not to be further concerned with the used ingredient or manufacturing stage, and to meet the standard, but flavor similar to process cheese type products and the product which has textures are included.

[0008]Many efforts have been made in order to generate the strong and flavored cheese-head ingredient which can be used for process cheese in a short period. For example, U.S. Pat. No. 4752483 is aimed at the method of generating the cheese-head ingredient flavored strongly. In this method, cheese curd is generated first, the "green" Cheddar type cheese curd produced as a result is ground, and then it will incubate for six days from about five days together with protease, lipase, and water. The term of "green" Cheddar type cheese curd points out the cheddar cheese which riped [less than] on about the 60th.

[0009]U.S. Pat. No. 4172900 is aimed at manufacturing the natural cheese products which have the American cheese-head flavor which was adapted in order to use for preparation of process cheese, and which was reinforced remarkably. In this method, cheese curd is generated by the usual method of manufacturing milk well coagulums, cutting a coagulum and forming a card and whey, and carrying out the effluent of this whey and forming cheese curd. enough to generate the particles of a card and generate C_2 of the quantity which was mixed with the salt, the source of stearolytic enzyme, and the source of protease, and increased compared with the usual American type cheese head - C_{10} fatty acid -- period hardening is

carried out.

[0010]U.S. Pat. No. 4119732 is aimed at the method of manufacturing a cheese head promptly. In this method, rennet, kid goat lipase, and calf lipase are mixed for milk during a fermentation period. Next, this milk is solidified and it processes by the usual procedure of manufacturing the cheddar cheese which cuts and includes the effluent stage of whey in card particles continuously. The cheddar cheese flavor which formed this card in the cheese block, riped the cheese block for about ten weeks, and riped about intensity is provided.

[0011]U.S. Pat. No. 3975544 has indicated how to manufacture the pasteurization milk well cheddar cheeses which add an enzyme mixture on a cheddaring card, in order to shorten the cure time of a cheese block substantially. This cheese block is hardened for one month at 10 to 25 **.

[0012]U.S. Pat. No. 4244971 is aimed at the method of manufacturing a cheese product promptly. In this method, a culture cheese-head ingredient carries out protein breakdown of the milk protein, carries out lipolysis of the milk fat, and is prepared by forming the mixed fermented material of such hydrolysis materials. This mixed fermented material is fermented together with a cheese starter culture, and a culture cheese-head ingredient is provided. Next, a culture cheese-head ingredient is mixed with a milk protein concentrate and a fat concentrate. This mixture is fermented and the cheese-head material which can make process cheese type products by the usual cheese-head cooking technique is provided.

[0013]Simultaneous pendency U.S. patent application 09th which applies on May 19, 1999 and the same grantee as this application owns / No. 314713, Processing using protease was performed before the heating stage, and the method of manufacturing enzyme denaturation cheese-head flavoring that this enzyme treatment was a short time comparatively (namely, usually less than about 12 hours) was provided. The stage of contacting the fluid of the dairy products containing (i) whey protein to protease, and providing this method with a dairy-products reaction mixture, (ii) Sufficient period to hydrolyze protein selectively, the stage which incubates a dairy-products reaction mixture at sufficient temperature, (iii) The stage which pasteurizes at low temperature the dairy-products reaction mixture hydrolyzed selectively, (iv) Contact a pasteurization mixture to the constituent containing lipase and cheese-head culture, Sufficient time to reveal cheese-head flavor, the stage which incubates at sufficient temperature, and (v) culture were inactivated, the microorganism impurity was annihilated, the stage of processing a fermentative mixture with sufficient heat to inactivate an enzyme was included, and enzyme denaturation cheese-head flavoring was provided by it.

[0014]Simultaneous pendency U.S. patent application 09th which applies on August 27, 1998 and the same grantee as this application owns / No. 141082, The method of manufacturing the ingredient which is used for manufacturing a cheese head for a short period of time and which was flavored strongly was provided without [without it uses a whey effluent stage, or]

generating cheese curd. The cheese-head flavor catalyst precursor (namely, aquosity, acidification protein, and a fat substrate) was prepared by setting desiccation or a concentration protein source, the source of a fat, an acid source, and water, and mixing. Next, the enzyme system was added to this substrate. Lipase, protease, and peptidase were contained in the enzyme system. Next, sufficient time to provide the cheese-head flavor remarkably revealed in the substrate and this substrate were fermented. Then, the substrate was heated to sufficient temperature to inactivate an enzyme system, and it held at the temperature sufficient time.

[0015]Although these methods generally provide the cheese-head ingredient flavored strongly, they are restricted to the flavor profile suitable for generally manufacturing a single kind of flavoring cheese head. Therefore, the cheese head which has a flavor profile of a greatly different request cannot be manufactured using these methods. Each of these methods has the sharp Cheddar scent tone, or does not generate the cheese-head ingredient which gives it and which was flavored strongly.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]Therefore, it is desirable to provide the cheese-head flavor system which can prepare the cheese head which has a flavor profile which a request is large and is different by it. It is desirable to provide the cheese-head flavor system which can reproduce the flavoring cheese head of various requests only using a small number of taste component. It is desirable to provide the cheese-head ingredient which has the sharp Cheddar scent tone and which was flavored strongly. This invention has such a cheese-head flavor system and the sharp Cheddar scent tone, or provides the cheese-head ingredient which gives it and which was flavored strongly.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem]This invention relates to a natural living thing generation cheese-head flavor system which can be used in order to prepare a cheese head which has a desired flavor profile generally. This invention relates to details more at a cheese-head flavor system containing a "sulfur Cheddar" taste component, a "cream butter" taste component, and a "cheese-head" taste component. Each of these taste components can be used as a flavor constitutional unit provided with a respectively specific flavor profile and/or the flavor characteristic. A cheese head which has various flavors can be manufactured by using combination with these various taste components (namely, culture cheese-head concentrate of this invention). These flavor concentrates are independently prepared from a milk substrate condensed highly using an enzyme, culture, an additive agent, and a process condition which were designed provide a taste component which has a specific flavor profile and/or the flavor characteristic. These flavor concentrates can be used in order to prepare process cheese provided with a desired flavor profile, or other cheese heads. This flavor concentrate can be added to a milk substrate used in order to manufacture a cheese head, and after that, a milk substrate is processed in order to manufacture a desired cheese head. In order to manufacture a desired cheese head as an exception method, this flavor concentrate can be added at a cheese head or a dairy-products base (namely, cheese curd and/or dairy-products solid content without a desired flavor profile). This flavor concentrate can also be used for other foodstuffs as a natural flavor system.
[0018]Provide this invention and a flavor system containing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component a sulfur Cheddar taste component, The 1st milk concentrate by lactic acid culture and option by stearolytic enzyme and high-protein decomposition activity culture. The 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH is obtained, Add a sulfur content substrate into the

1st mixture, form the 2nd mixture, and the 2nd mixture Brevibacteriumlinens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacteriumlinens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 3rd mixture will be formed, [about ten days and] It is prepared by processing the 3rd mixture at sufficient temperature to inactivate culture and an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component, and a cream butter flavor ingredient the 2nd milk concentrate Lactic acid culture, By option, using stearolytic enzyme From about 10 hours to and about 24 hours. Process at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), form the 4th mixture, add sodium acid citrate into the 4th mixture, form the 5th mixture, and the 5th mixture by diacetyl generation flavor culture. For [from about one day] about ten days, process by about 90 Fahrenheit (about 32 **) from about 70 Fahrenheit (about 21 **), and the 6th mixture is formed, By processing the 6th mixture at sufficient temperature to inactivate culture and an enzyme in the 6th mixture, and forming a cream butter flavor ingredient, it is prepared and a cheese-head taste component, Lipase, protease, and peptidase are used for the 3rd milk concentrate, Will process from about 0.5 day at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 7th mixture will be formed, [about ten days and] It is prepared by processing the 7th mixture at sufficient temperature to inactivate an enzyme in the 7th mixture, and forming a cheese-head taste component, A sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component of this cheese-head flavor system can be mixed with foodstuffs in various quantity, and can generate various flavors. In order that especially a flavor system of this invention may manufacture a cheese product, it conforms to mixing with a cheese head or a dairy-products base.

[0019]Provide this invention further and a cheese-head flavor system containing a sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component a sulfur Cheddar taste component, The 1st milk concentrate by stearolytic enzyme and option by lactic acid culture and option High-protein decomposition activity culture, A sulfur content substrate and Brevibacterium linens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacterium linens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 1st mixture will be formed, [about ten days and] By processing the 1st mixture at sufficient temperature to inactivate culture and an enzyme in the 1st mixture, and forming a sulfur Cheddar taste component, it is prepared and a cream butter flavor ingredient, The 2nd milk concentrate using stearolytic enzyme, diacetyl generation flavor culture, and sodium acid citrate by lactic acid culture and option From about one day to about ten days. Process at

temperature of about 70 (about 21 **) to about 90 Fahrenheit (about 32 **), and the 2nd mixture is formed, By processing the 2nd mixture at sufficient temperature to inactivate culture and an enzyme in the 2nd mixture, and forming a cream butter flavor ingredient, it is prepared and a cheese-head Mr. taste component, Lipase, protease, and peptidase are used for the 3rd milk concentrate, Will process from about 0.5 day at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 3rd mixture will be formed, [about ten days and] It is prepared by processing the 3rd mixture at sufficient temperature to inactivate an enzyme in the 3rd mixture, and forming a cheese-head taste component, A sulfur Cheddar taste component, a cream butter flavor ingredient, and a cheese-head taste component of this cheese-head flavor system can be mixed with a cheese head or a dairy-products base in various quantity, and a cheese head which has various flavors can be manufactured.

[0020]The sharp Cheddar taste component or a concentrate can also be independently used, in order to substitute for a flavoring cheese head ripe in manufacture of process cheese again. Thus, this invention provides a method of generating the sharp Cheddar taste component or a concentrate for using in cheesemaking further. A flavor scent tone specific to natural cheese can be independently used for this sharp Cheddar taste component or concentrate, in order to provide with the sharp Cheddar scent tone addition, especially a very young cheddar cheese. Thus, provide this invention further and a sulfur Cheddar taste component for using it for flavoring of a cheese head this sulfur Cheddar taste component, A milk concentrate by lactic acid culture and option by stearolytic enzyme and high-protein decomposition activity culture. The 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH is formed, Add a sulfur content substrate into the 1st mixture, form the 2nd mixture, and the 2nd mixture Brevibacterium linens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacterium linens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, It is prepared by processing from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), forming the 3rd mixture, processing the 3rd mixture at sufficient temperature to inactivate an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component. [about ten days and]

[0021]In this method, a starting material is a milk concentrate containing aquosity protein and a fat content mixture. Generally this water milk origin concentrate (namely, milk system condensed highly) has about 10% from about 0.5% of a lactose content about 30% from about 15% of a fat content about 19% from about 10% of a protein content about 50% from about 30% of the total solid content. Preferably, this aquosity milk origin concentrate has about 5% from about 0.5% of a lactose content about 25% from about 18% of a fat content about 17% from about 12% of a protein content about 47% from about 35% of the total solid content. Preferably, this aquosity milk origin concentrate or substrate is a recombined milk substrate

prepared from a mixture of a fluid milk concentrate prepared by an ultrafiltration/diafiltration (UF/DF) or UF/DF powdered milk, and milk fat. As shown in drawing 1, this fluid milk concentrate is divided into three portions next, and each is processed with a specific flavor enzyme, culture, an adjuvant, and other additive agents during sufficient predetermined period for making the specific flavor characteristic reveal (namely, fermentation). By using this method, a "sulfur Cheddar" ingredient, a "cream butter" ingredient, and a "cheese-head" ingredient are generable. Next, it heats to sufficient temperature to inactivate the enzyme / culture system which used each portion in order to prepare a specific taste component, and holds at the temperature sufficient time. Generally, in order to mainly prepare three sorts of taste components [each of] of a cheese-head flavor system of this invention for convenience, it is preferred to use a same or similar milk concentration constituent, but if it is a request, in order to prepare three sorts of taste components [each of], a separate milk concentration constituent can be used.

[0022]After a heating inactivation stage, in order to provide a strong and flavored culture concentrate, three sorts of taste components or a substrate can be used independently, or can be set by two sorts or three sorts of groups. If it is a request, a sulfur Cheddar ingredient which has a strong sulfur scent tone can be independently used, in order to provide the sharp Ajika tone of the Cheddar style. However, preferably, in order to provide various flavoring cheese heads, this flavor system is various quantity and three sorts of all taste components are used for it. This taste component or concentrate can manufacture the cheese head / dairy-products powder which could use directly, or dried (for example, spray drying), and was flavored strongly.

[0023]This flavor concentrate or cheese-head powder can be used in order to prepare various flavoring cheese heads. Provide this invention further and a method of preparing a flavoring cheese head using a culture cheese-head concentrate said method, (1) Including mixing with a cheese-head base what a cheese-head base is prepared for, and about 1% of (2) to about 10% of culture cheese-head concentrate, and forming a flavoring cheese head this culture cheese-head concentrate, Including 0 to about 80% of sulfur Cheddar taste component, about 10 to about 90% of cream butter flavor ingredient, and about 10 to about 90% of cheese-head taste component, a sulfur Cheddar taste component, The 1st milk concentrate by lactic acid culture and option by stearolytic enzyme and high-protein decomposition activity culture. The 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH is obtained, Add a sulfur content substrate into the 1st mixture, form the 2nd mixture, and the 2nd mixture Brevibacteriumlinens culture, Using yeast of Debaromyces or Kluyeromyces group origin so that Brevibacteriumlinens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it From about three days to or about ten days. Process at

temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and the 3rd mixture is formed, By processing the 3rd mixture at sufficient temperature to inactivate culture and an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component, it is prepared and a cream butter flavor ingredient, Stearolytic enzyme is used for the 2nd milk concentrate by lactic acid culture and option, Process from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and the 4th mixture is formed, Add sodium acid citrate into the 4th mixture, form the 5th mixture, and the 5th mixture by diacetyl generation flavor culture. For [from about one day] about ten days, process by about 90 Fahrenheit (about 32 **) from about 70 Fahrenheit (about 21 **), and the 6th mixture is formed, By processing the 6th mixture at sufficient temperature to inactivate culture and an enzyme in the 6th mixture, and forming a cream butter flavor ingredient, it is prepared and a cheese-head taste component, Will process the 3rd milk concentrate from about 0.5 day using lipase, protease, and peptidase at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 7th mixture will be formed, [about ten days and] It is prepared by processing the 7th mixture at sufficient temperature to inactivate an enzyme in the 7th mixture, and forming a cheese-head taste component, Quantity of a sulfur Cheddar taste component in a culture cheese-head concentrate, a cream butter flavor ingredient, and a cheese-head taste component and quantity of a culture cheese-head concentrate mixed with a cheese-head base can be adjusted in order to obtain a flavoring cheese head which has various flavors.

[0024]Provide this invention further and a method of preparing a flavoring cheese head using a culture cheese-head concentrate said method, (1) Mix [what a milk substrate suitable for manufacture of a cheese head is prepared for,] about 1% of (2) to about 10% of culture cheese-head concentrate with a milk substrate, (3) Process a milk substrate and a culture cheese-head concentrate, and solidify a milk substrate, (4) Cook cutting a coagulation milk substrate and forming a card and whey, (5) cards, and whey, (6) Including separating a card from whey, and forming a flavoring cheese head from a card which carried out (7) separation this culture cheese-head concentrate, Including 0 to about 80% of sulfur Cheddar taste component, about 10 to about 90% of cream butter flavor ingredient, and about 10 to about 90% of cheese-head taste component, a sulfur Cheddar taste component, The 1st milk concentrate by lactic acid culture and option by stearolytic enzyme and high-protein decomposition activity culture. Obtain the 1st mixture that processes from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and has about 5.4 or less pH, add a sulfur content substrate into the 1st mixture, and the 2nd mixture is formed, The 2nd mixture Brevibacteriumlinens culture, Or yeast of Debaromyces or Kluyeromyces group origin is used, So that Brevibacteriumlinens culture or yeast can convert a sulfur content substrate into a sulfur content flavor compound by it, Will process from about three days at temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **), and

the 3rd mixture will be formed, [about ten days and] By processing the 3rd mixture at sufficient temperature to inactivate culture and an enzyme in the 3rd mixture, and forming a sulfur Cheddar taste component, it is prepared and a cream butter flavor ingredient, Stearolytic enzyme is used for the 2nd milk concentrate by lactic acid culture and option, Process from about 10 hours for about 24 hours at temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and the 4th mixture is formed, Add sodium acid citrate into the 4th mixture, and form the 5th mixture, and process the 5th mixture by about 90 Fahrenheit (about 32 **) by diacetyl generation flavor culture from about ten days from about one day, and about 70 Fahrenheit (about 21 **), and the 6th mixture is formed, By processing the 6th mixture at sufficient temperature to inactivate culture and an enzyme in the 6th mixture, and forming a cream butter flavor ingredient, it is prepared and a cheese-head taste component, Lipase, protease, and peptidase are used for the 3rd milk concentrate, Will process from about 0.5 day at temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and the 7th mixture will be formed, [about ten days and] It is prepared by processing the 7th mixture at sufficient temperature to inactivate an enzyme in the 7th mixture, and forming a cheese-head taste component, Quantity of a sulfur Cheddar taste component in a culture cheese-head concentrate, a cream butter flavor ingredient, and a cheese-head taste component and quantity of a culture cheese-head concentrate mixed with a milk substrate can be adjusted in order to obtain a flavoring cheese head which has various flavors.

[0025]

[Embodiment of the Invention]In the method of this invention, a starting material is the milk concentrate or substrate of the gestalt of aquosity protein and a fat content mixture. As above-mentioned, in order to mainly prepare three sorts of taste components [each of] of a cheese-head flavor system of this invention for convenience generally, it is preferred to use a same or similar milk concentration constituent, but if it is a request, in order to prepare three sorts of taste components [each of], a separate milk concentration constituent can be used. Generally the milk origin concentrate of this aquosity or two or more concentrates (namely, milk system condensed highly) have about 10% from about 0.1% of a lactose content about 30% from about 15% of a fat content about 19% from about 10% of a protein content about 50% from about 30% of the total solid content. Preferably, this aquosity milk origin concentrate has about 5% from about 0.5% of a lactose content about 25% from about 18% of a fat content about 17% from about 12% of a protein content about 47% from about 35% of the total solid content. Generally the amount of hygroscopic surface moisture of this substrate is about 53% to about 65% preferably about 70% from about 50%. The protein source can be dry protein or concentration material, and are a dairy-products ingredient, for example, a milk protein concentrate, fractionation milk protein, a concentrated milk fat, whey protein concentrate, dry whey, powdered skim milk, or those mixtures preferably. The sources of a fat are milk fat, for

example, anhydrous milk fat, butter, cream, or those mixtures preferably. Soybean protein, corn protein, wheat protein, rice protein, etc. can use other protein sources. Other sources of a non-dairy product fat, such as vegetable oil, can be used. pH of a milk concentrate or a substrate -- general -- about 6 to about 7 range -- it is about 6.5 to about 6.7 range preferably.
[0026]A dry protein source is returned with water, when using. Water is used in sufficient quantity for the total hygroscopic surface moisture in a substrate to be about 53 to about 65% from about 50% preferably about 70%. Together with the source of a fat, a substrate is provided for this source of reduced protein. If required, edible acid can be added or pH of a substrate can be lowered to the suitable range (from about 4.8 to about 5.6 [From about 4.6 to about 6.0 / namely, / preferably]) using a lactic acid generation microorganism. Suitable edible acid is avirulent inorganic matter or organic acid, and chloride, acetic acid, maleic acid, tartaric acid, citrate, phosphoric acid, lactic acid, and those mixtures are contained. In preparation of a milk concentrate, if it is a request and/, or necessity in order to reduce fat drop particle diameter and to secure the homogeneity of a substrate, a homogenizer can be used.
[0027]Preferably this aquosity milk origin concentrate or substrate, It is the recombined milk substrate prepared from the mixture of the fluid milk concentrate prepared by the ultrafiltration (it is independent or put together as diafiltration still more preferably), an ultrafiltration (UF) or an ultrafiltration / powdered milk by which diafiltration (UF/DF) was carried out, and milk fat. It is UF/DF milk which has the characteristic of the following [starting material] preferably.
[0028]
[Table 1]

	典型量（%）	好ましい量（%）	より好ましい量（%）
総固形分	30-50	35-47	40
湿分	50-70	53-65	60
脂肪	15-30	18-25	21
タンパク質	10-19	12-17	14.5
ラクトース	0.1-10	0.5-5	1
塩	1-3	1-2	1-2
灰分	0.5-2.5	1-2	1-2
pH	6-7	6.5-6.7	6.6

[0029]A desirable starting material can be prepared from the pasteurization (from about 2% to about 15% [From 0% to about 20% preferably]) whole milk or skim milk which added cream. This milk substrate by a heat exchanger From about 110 Fahrenheit (about 43 **) to next, about 140 Fahrenheit (about 60 **). It heats to about 120 Fahrenheit (about 49 **) preferably, and after that, the usual ultrafiltration / diafiltration technique are presented, and about 8 times [about 3 to] (preferably about 5 times) as many milk concentration output is generated. For example, after heating for about 16 seconds by 168 Fahrenheit (about 76 **) and cooling from

about 70 Fahrenheit (about 21 **) to about 80 Fahrenheit (about 27 **), this milk concentrate substrate can be used in order to prepare the specific taste component of this invention. In order to generate a specific taste component preferably, before processing with various enzymes / culture / additive agents, about 1 to about 2% of salt is added to a milk concentrate substrate. This milk concentrate is a fluid which is viscous in comparison, and contains about 35 to about 47% of solid content preferably.

[0030]As shown in drawing 1, the fluid milk concentrate which contains about 1 to about 2% of salt preferably is divided into three portions next, and each is processed with a specific enzyme, culture, an adjuvant, and other additive agents during sufficient predetermined period for making the specific flavor characteristic reveal (namely, fermentation). A specific enzyme, culture, an adjuvant, and other additive agents are given, and a "sulfur Cheddar" ingredient, a "cream butter" ingredient, and a "cheese-head" ingredient can be generated from there. Although not shown in drawing 1, the uniformity stage of option can be presented with the flow of each ingredient in front of fermentation or in the back. After fermentation, each portion is heated to sufficient temperature to inactivate culture and an enzyme system, and is held to the temperature sufficient time.

[0031]After a heating inactivation stage, in order to provide the strong and flavored culture cheese-head concentrate, three sorts of taste components or a substrate can be used independently, or can be set by two sorts or three sorts of groups. Preferably, the culture cheese-head concentrate of this invention contains 0 to about 80% of sulfur Cheddar ingredient, about 10 to about 90% of cream butter ingredient, and about 10 to about 90% of cheese-head ingredient. The culture cheese-head concentrate of this invention contains about 25 to about 75% of sulfur Cheddar ingredient, about 25 to about 75% of cream butter ingredient, and about 25 to about 75% of cheese-head ingredient more preferably. This culture cheese-head concentrate can be a physical compound of an ingredient, and it is used in order to prepare the flavoring cheese head of a request of that compound next. As an exception method, this culture cheese-head concentrate can be formed by adding an ingredient separately to a cheese-head substrate. The constituent produced as a result is used in order to prepare a desired flavoring cheese head after that.

[0032]As illustrated in the Example 5, this flavor constitutional unit material (namely, three sorts of taste components) can be added to a milk substrate, and it is used in order to form a cheese head next. As illustrated in the Example 6 as an exception method, this flavor constitutional unit material can be added at the already prepared cheese-head base. The relative amount of the three-sort ingredient in a culture cheese-head concentrate and the total amount of a culture cheese-head concentrate mixed can be various in order to obtain the combination or flavor scent tone of specific flavor according to the desired flavor characteristic. Using three sorts of ingredients, and a cheese-head base, the cheese-head type across which

it goes variably can be prepared so that it may illustrate to the following table 2.

[0033]

[Table 2]

本発明の培養チーズ濃縮物を用いて調製したチーズの例

チーズ		培養チーズ濃縮物（重量部）		
		硫黄チェダー	クリームバター	チーズ
プロセスチーズ		1.7	7	1.3
クリームチーズ		0	8	2
チェダー	ミディアム	1	6	3
	シャープ	3.3	3.3	3.3
	エクストラシャープ	6	1	3
モッツァレラ		0	7.5	2.5
パルメザン		1	3	6
ロマノ		1	1	8

[0034]Generally, the cheese head produced as a result contains about 2 to about 6% of culture cheese-head concentrate preferably about 10% from about 1%. The engineer of the field will understand that both various relative amounts and total amounts of an ingredient can be changed and/or optimized for the time being, in order to obtain a desired flavor profile especially, though natural. Three sorts of these ingredients can be used in order to obtain other flavoring cheese heads, and they can be used for various cheese-head bases (for example, process cheese, process cheese type foodstuffs, natural cheese, cream cheese, cottage cheese, etc.).

[0035]As it mentions above and was shown in drawing 1, this fluid milk concentrate is divided into three portions, and each is processed with a specific enzyme, culture, an adjuvant, and other additive agents during sufficient predetermined period for making the specific flavor characteristic reveal (namely, fermentation). A specific enzyme, culture, an adjuvant, and other additive agents are given, and a "sulfur Cheddar" ingredient, a "cream butter" ingredient, and a "cheese-head" ingredient can be generated from there. The process of preparing these ingredients does not need a whey effluent stage. Preparation of each taste component is indicated below.

[0036]Preparation of a sulfur Cheddar ingredient sulfur Cheddar ingredient is preferably carried out at two steps of processes shown in drawing 1. In the 1st phase, lactic acid culture is added to a milk substrate, it maintains from about 10 hours for about 24 hours by about 70 (about 21 **) to about 86 Fahrenheit (about 30 **), and about 5.4 or less pH is acquired. Preferably, stearolytic enzyme and high-protein decomposition activity culture, or protease is further added

with lactic acid culture in the 1st step. Next, the Brevibacterium linens culture by which culture or yeast can convert a sulfur content substrate into the sulfur content flavor compound which is sensuously effective by it, Or yeast of Debaromyces or Kluyeromyces group origin and a sulfur content substrate are added, and fermentation will be continued for ten days from about three more days at the temperature of about 65 (about 18 **) to about 86 Fahrenheit (about 30 **) (preferably about 72 Fahrenheit (about 22 **)). Preferably, in order to form a sulfur content compound, Brevibacterium linens culture is used. Between two fermentation stages, any enzyme / culture heating inactivation should not exist. An enzyme can be generated from various microorganisms or can be extracted from vegetation or an animal tissue. Various enzymes of this enzyme system are marketed in the shape of the end of dried powder, or a fluid. Preferably, both stages are carried out with a single container. Preferably, a reaction mixture is aerated during fermentation, in order to prevent non-gaseous state voice and to provide good mixing. Generally, conditions should be maintained so that phase separation under fermentation may be made into the minimum. When phase separation happens, arbitrary uniformity steps can be used after fermentation. After completing two fermentation steps or a stage, culture and an enzyme are inactivated for about 16 seconds to about 30 minutes by about 190 Fahrenheit (about 88 **) heating by about 155 Fahrenheit (about 68 **) for about 10 minutes preferably from about 145 Fahrenheit (about 63 **). In order to raise heat transfer preferably, a reaction mixture is recycled during inactivation.

[0037]In order to form a sulfur content compound as above-mentioned, Brevibacterium linens culture is used preferably. If it is a request, the microorganism which denaturalized genetically so that the activity of Brevibacterium linens resemblance might be provided can be used instead of Brevibacterium linens culture. The purpose of this invention is considered that such a microorganism that denaturalized genetically is included by the term of "Brevibacterium linens culture."

[0038]They are tripeptide in which a "sulfur content substrate" contains a sulfur content free amino acid and sulfur content amino acid about the purpose of this invention, and a protein hydrolyzate containing sulfur content amino acid. the foodstuffs protein hydrolyzate for which it was suitable -- Quest International (Illinois.) It is a trade name of N-Z-Amine from Hoffman Estates, N-Z-Case, Hy-Case, and Pepticase, and can obtain from other manufacturers. Preferably, L-methionine, L-glutathione, and L-cysteine are contained in a sulfur content substrate. In an especially desirable embodiment, a sulfur content substrate is a mixture of the mixture of the mixture of L-methionine and L-glutathione, L-methionine, and L-cysteine or L-methionine, L-glutathione, and L-cysteine. Generally a sulfur content substrate is added in about 0.01 to about 1% of quantity.

[0039]In a desirable embodiment, especially a sulfur Cheddar ingredient, A milk concentrate (from pH about 6.0 to about 6.7) in the 1st step Lactic acid culture, By stearolytic enzyme and

high-protein decomposition activity culture, process and After that, . Added L-methionine and L-glutathione, without inactivating. Or it is prepared by having added L-methionine and L-cysteine, or processing further by the Brevibacterium linens culture which added L-methionine, L-glutathione, and L-cysteine. This 1st step is carried out from about 10 hours for about 24 hours at the temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **). The 2nd step will be preferably carried out for [from about four days] about eight days for ten days from about one day at the temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **). As for two stages, as shown in drawing 1, it is preferred to carry out sequentially, but it can also collect into a single fermentation stage. Generally the fermentation process of such a single stage is carried out by about 86 Fahrenheit (about 30 **) from about 65 Fahrenheit (about 18 **) for [from about three days] about ten days.

[0040]The especially desirable presentation for preparing a sulfur Cheddar ingredient is indicated to the following table 3. Example 1 illustrates preparation of a sulfur Cheddar ingredient using the ingredient and the "amount of types" which were mentioned to Table 3.

[0041]

[Table 3]

硫黄チェダー成分を調製するための特に好ましい組成

成分	範囲(%)	典型量(%)	機能
5倍UF／DF乳	バランス	98.78	乳基質
第1段階			
前胃エステーゼ	0-1	0.02	脂肪を遊離脂肪酸に加水分解するための脂肪分解酵素
Lactococcus lactis、および Lactococcus lactis 亜種 cremoris	0.001-2	0.01	ラクトースを乳酸に転換し、pHを下げるためのスターターカルチャー
Micrococcus	0.0001-1	0.001	カゼインをペプチドに転換する高タンパク質分解活性を備えた風味補助剤培養菌
第2段階			
Brevibacterium linens	0.001-2	0.01	硫黄風味化合物を生成するための風味補助剤培養菌
Lメチオニン	0.01-1	0.1	硫黄化合物生成のためのアミノ酸基質
Lグルタチオン	0.01-1	0.1	トリペプチド基質および風味発現のための酸化還元平衡状態を作る処理助剤、遊離アミノ酸に加水分解

[0042]Generally other sulfur content substrates exist in about 0.01 to about 1% of quantity, when using. Fermentation is carried out in the state of aeration, in order to prevent a reaction

mixture serving as non-mind preferably and to provide good mixing. Preferably, it aerates by introducing air into a reaction mixture using a diffusion plate or an in-series air sparger. if suitable, when phase separation happens namely,, a reaction mixture can be uniformed in advance of the further processing by option. Culture and an enzyme are inactivated for about 16 seconds to about 30 minutes after fermentation by heating by about 185 Fahrenheit (about 85 **) from about 150 Fahrenheit (about 66 **). Preferably, aeration stops between heating inactivation processes.

[0043]This sulfur content substrate is added in order to help generation of a sulfur compound important for the manifestation of the Cheddar flavor, especially the sharp Cheddar flavor. L-methionine, L-glutathione, L-cysteine, and those mixtures are contained in a desirable sulfur content substrate. Since a sulfur compound is produced by operation of Brevibacterium linens culture or yeast (preferably Brevibacterium linens), L-methionine is used. This tripeptide L-glutathione (namely, glutamine cystein glycine) and amino acid L-cysteine, In addition to working as a substrate, it acts also as a processing auxiliary agent which makes the oxidation reduction equilibrium situation which promotes flavor generation by producing a desired sulfur flavor compound (namely, methanethiol, dimethyl disulfide, and dimethyl trisulfide). The hydrolysis to the free amino acid of L-glutathione by microbial enzymes is expected during a fermentation period. The further hydrolysis may take place during the next heat-treatment (namely, under inactivation and/or the mixture to a cheese-head base). Generally, the quantity of L-glutathione expected from the last cheese product (namely, flavoring cheese product manufactured using the cheese-head flavor system of this invention) is less than about 10 ppm.

[0044]The generated sulfur Cheddar ingredient which is produced as a result is the fluid or paste which has a hygroscopic-surface-moisture content of about 53 to about 65% of range preferably about 70% from about 50% typically. Without not adding supporting materials, such as a whey concentrate or malto dextrin, or adding them, spray drying of this sulfur Cheddar ingredient can be carried out, and it can provide powder. Generally this sulfur Cheddar ingredient has the flavor characteristic / profile of the following shown in Table 4. They are not detected although it seems that this sulfur Cheddar ingredient contains other effective aroma or flavor compounds containing a sulfur content compound.

[0045]

[Table 4]

硫黄チェダー成分の典型的な風味プロファイル

	範囲	典型量
メタンチオール*	700-15M	3.7M
二硫化ジメチル*	1M-50M	9.7M
三硫化ジメチル*	1M-50M	6.9M
酢酸	500-1500 ppm	916 ppm
プロピオン酸	<25-100 ppm	<25 ppm
酪酸	100-500 ppm	285 ppm
ヘキサン酸	10-200 ppm	92 ppm
オクタン酸	10-200 ppm	45 ppm
デカン酸	10-200 ppm	64 ppm
ドデカン酸	10-200 ppm	82 ppm

[0046]* A sulfur compound is reported by the peak value area determined using the gas chromatography. M= million. The initial peak value area of these sulfur compounds was 0 intrinsically.

[0047]Preparation of a cream butter ingredient cream butter ingredient is preferably carried out at two steps of processes shown in drawing 1. Preparation of a cream butter ingredient adds lactic acid culture to a milk concentrate, and then carries out the mixture from about 10 hours by fermenting in about 86 Fahrenheit (about 30 **) from about 70 Fahrenheit (about 21 **) for about 24 hours. Preferably, stearolytic enzyme is further added to a milk concentrate with lactic acid culture. Next, diacetyl generation flavor culture and sodium acid citrate are added, and about 90 Fahrenheit (about 32 **) continues fermentation by about 82 Fahrenheit (about 28 **) preferably from about 70 Fahrenheit (about 21 **) for [from about five days] about eight days for [from about one day] about ten days. An enzyme can be generated from various microorganisms or can be extracted from vegetation or an animal tissue. Various enzymes of this enzyme system are marketed in the shape of the end of dried powder, or a fluid. Preferably, a reaction mixture is aerated during fermentation, in order to prevent non-gaseous state voice and to provide good mixing. Phase separation is not a remarkable problem under fermentation. After a fermentation step is completed, culture and an enzyme are inactivated for about 16 seconds to about 30 minutes by heating from about 145 Fahrenheit (about 63 **) for about 10 minutes preferably to about 190 Fahrenheit (about 88 **) at about 155 Fahrenheit (about 68 **).

[0048]In a desirable embodiment, especially a cream butter ingredient, A milk concentrate (from pH about 6.0 to about 6.7) in the 1st step Lactic acid culture, And without processing by rumina esterase, next inactivating, sodium acid citrate is added (from about 0.05% to about 5% [Generally]), and it is prepared by processing by one sort or two or more culture which can generate diacetyl from citrate further. Leuconostoc and the Lactococcus lactis subspecies

lactis biovar diacetylactis are contained in desirable diacetyl generation culture. This 1st-step fermentation is carried out from about 10 hours for about 24 hours at the temperature of about 70 (about 21 **) to about 86 Fahrenheit (about 30 **). The 2nd step will be carried out for about ten days from about one day at the temperature of about 70 (about 21 **) to 90 Fahrenheit (about 32 **). As for two stages, as shown in drawing 1, it is preferred to carry out sequentially, but it can also collect into a single fermentation stage. Generally the fermentation process of such a single stage will be carried out for about ten days from about one day at the temperature of about 70 (about 21 **) to 90 Fahrenheit (about 32 **).

[0049]Leuconostoc and Lactococcus lactis subspecies lactis biovar diacetylactis culture are desirable diacetyl generation flavor culture as above-mentioned. If it is a request, the microorganism which denaturalized genetically so that similar activity might be provided can be used instead of Leuconostoc and/or Lactococcus lactis subspecies lactis biovar diacetylactis culture. The purpose of this invention is considered that such a microorganism that denaturalized genetically is included by the term of "diacetyl generation flavor culture."

[0050]The especially desirable presentation for preparing a cream butter ingredient is indicated to the following table 5. Example 2 illustrates preparation of a cream butter ingredient using the ingredient and the "amount of types" which were mentioned to Table 5.

[0051]

[Table 5]

クリームバター成分を調製するための特に好ましい組成

成分	範囲（%）	典型量（%）	機能
5倍 UF/DF 乳	バランス	89.83	乳基質
第1段階			
前胃ｴｽﾃﾗｰｾﾞ	0-1	0.02	脂肪を遊離脂肪酸に加水分解する脂肪分解酵素
Lactococcus lactis、および Lactococcus lactis 亜種 cremoris	0.001-2	0.01	ラクトースを乳酸に転換し、ｐＨを下げるためのスターターカルチャー
第2段階			
ｸｴﾝ酸ﾅﾄﾘｳﾑ	0.01-10	0.3	ジアセチル生成、および風味発生の基質
Leuconostoc	0-1	0.0001	クエン酸塩からジアセチルを生成するための風味補助剤培養菌
Lactococcus lactis 亜種 lactis 次亜種 diacetylactis	0-1	0.0001	クエン酸塩からジアセチルを生成するための風味補助剤培養菌

[0052]After fermentation, culture and enzymes are about 190 Fahrenheit (about 88 **) from about 145 Fahrenheit (about 63 **) for about 16 seconds to about 30 minutes, and are preferably inactivated by heating by about 155 Fahrenheit (about 68 **) for about 10 minutes.

Preferably, aeration is not used after heating inactivation in process or a process.

[0053]The generated cream butter ingredient which is produced as a result is the fluid or paste which has a hygroscopic-surface-moisture content of about 53 to about 65% of range preferably about 70% from about 50% typically. Without not adding supporting materials, such as a whey concentrate or malto dextrin, or adding them, spray drying of this cream butter ingredient can be carried out, and it can provide powder. Generally this cream butter ingredient has the flavor characteristic / profile shown in Table 6. It seems that it is not detected and that this cream butter ingredient contains other aroma or flavor compounds which have effect.

[0054]

[Table 6]

クリームバター成分の典型的な風味プロファイル

	範囲（ｐｐｍ）	典型量（ｐｐｍ）
エタノール	1-150	41
アセトン	1-5	2
ジアセチル	20-400	173
酢酸	400-1000	360
プロピオン酸	<25-100	<25
酪酸	200-500	275
ヘキサン酸	20－150	86
オクタン酸	10-100	30
デカン酸	50-150	86
ドデカン酸	50-150	103

[0055]A cheese-head ingredient cheese-head ingredient can be prepared using the starting material and procedure which were generally indicated to simultaneous pendency U.S. patent application 09th of the August 27, 1998 application made into the part of this specification by reference / No. 141082. Lipase, protease, and peptidase are contained in the enzyme system used in order to prepare this cheese-head ingredient. A substrate will be preferably processed by this enzyme system for about three days from about one day at the temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **), and a desired cheese-head flavor level will be made to reach for [from about 0.5 day] about ten days. An enzyme can be generated from various microorganisms or can be extracted from vegetation or an animal tissue. Various enzymes of this enzyme system are marketed in the shape of the end of dried powder, or a fluid.

[0056]Lipase (called esterase) is an enzyme known well for the time being in the fields. Lipase is typically obtained from the throat tissue of a young animal (the calf, a kid goat, or a lamb), the pancreas of a mature animal, or the source of a microorganism. Dispensing of various marketing obtained from the throat organization can be obtained from SKW BioIndustries, Marschall Laboratory, or such other companies with various trade names. This enzyme is generable by grinding an edible throat with a salt and powdered skim milk, drying that mixture

and grinding again. The source of a microorganism of lipase, for example Candida cylindraceaTypeVIII of mold, They are Aspergilus oryzae, A.niger, Pencillium roqueforti, P.glaucum, and Phizopus oryzae.

[0057]Generally in preparation of a cheese-head ingredient, powder lipase (preferably bacillus lipase) is used in about 0.05 to about 0.4% of quantity. Suitable bacillus lipase is a trade name of Lipomod 187, and is marketed from Biocatalysts.

[0058]Protease is an enzyme which can be obtained from a bacillus, vegetation, or the source of an animal and which is known well for the time being in the fields. Biocatalyst to available Enzeco NeutralBacterialProtease 2X and available Promod 215 are contained in the example of the protease for which it was suitable from Enzyme Development Corp. Generally, powder protease is about 0.01 to about 1% of quantity, and is preferably used in 0.1 to about 0.4% of quantity.

[0059]Peptidase activity and the enzyme which has aminopeptidase activity preferably are used in this enzyme system, and such an enzyme acts on the bitter peptides produced from proteolysis. Peptidase enzyme produces the high-concentration free amino acid and small peptide which are contributed to cheese-head flavor in collaboration with protease enzyme. This peptidase can be refining enzyme material, or Lactobacillus helveticus etc. can be the cells of the microorganism which produces peptidase activity. This cultured cell can be spray drying, freeze-drying, freezing, or a newly cultured cell, and un-growing up or growth can be possible for it in a substrate. A spray drying Lactobacillus helveticus cell is preferably used in about 0.05 to about 0.30% of quantity about 3% from about 0.01%. A desirable enzyme is powder. However, probably, the suitable fluid shape of these enzymes is permitted by use by this invention.

[0060]A substrate will be preferably processed by this enzyme system for about three days from about one day, and a desired cheese-head flavor level will be made to reach for [from about 0.5 day] about ten days. This processing is carried out at the temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **). A desired flavor level can be judged sensuously and can presume the concentration of pH, titratable acidity, free fatty acid, and amino acid, etc. by analytical measurement. If target flavor is reached, a mixture will be heated to the temperature of about 160 (about 71 **) to about 210 Fahrenheit (about 99 **), and an enzyme will be inactivated by holding a substrate to the high temperature sufficient time (from about 5 minutes to for example, about 60 minutes) to make inactivation of a perfect enzyme into a positive thing.

[0061]In order to provide a desired flavor profile, the enzyme can add all simultaneously sequentially. In addition of a successive enzyme, one sort or two or more enzymes are added, and the processing term for about five days is carried out from about 4 hours. Then, the remaining enzymes are added and the further predetermined period and processing will be

continued from about 0.5 day for about five days. An inactivation step does not exist between successive additions of an enzyme.

[0062]In other embodiments of this invention, the 1st enzyme treatment is performed by the relatively high temperature of about 120 (about 49 **) to about 140 Fahrenheit (about 60 **). At least one sort of enzymes are added, and it incubates at about 2 to about 6 hours of the 1st processing, and this temperature. Next, the remaining enzymes are added at the 2nd processing term for about ten days from about 6 hours carried out at the temperature of about 60 (about 16 **) to about 140 Fahrenheit (about 60 **).

[0063]This process can be carried out with a single container, without moving to another container for a successive stage, and is performed such preferably. The container is preferentially provided with the mixed device, in order to secure the good contact between an enzyme and substrate material and to maintain the solid content in suspension. A scrape DOSA face mixing tank is preferred. In order to prevent separation from the aquosity material of a fat phase and to help maintenance of the solid content in suspension, recycle and a homogenizer can be used. In order to maintain a desired hygroscopic-surface-moisture content, water can be added during fermentation, and in order to adjust pH, acidity or a basic material can be added.

[0064]Especially, in a desirable embodiment, as shown in drawing 1, a cheese-head ingredient, The milk concentrate (from pH about 6.0 to about 6.7) which added phosphoric acid 1 sodium with the enzyme and bacillus protease which have neutral bacterial protease and aminopeptidase activity, and bacillus lipase. It is prepared for about two days by processing at the temperature of about 100 (about 38 **) to about 110 Fahrenheit (about 43 **).

[0065]The especially desirable presentation for preparing a cheese-head ingredient is indicated to the following table 7. Example 3 illustrates preparation of a cheese-head ingredient using the ingredient and the "amount of types" which were mentioned to Table 7.

[0066]

[Table 7]

チーズ成分を調製するための特に好ましい組成

成分	範囲（%）	典型量（%）	機能
5倍 UF/DF 乳	バランス	98.2	乳基質
ﾘﾝ酸一ﾅﾄﾘｳﾑ	0.1-3	1.0	懸濁液中の固形分の維持を助ける乳化剤
中性細菌ﾌﾟﾛﾃｱｰｾﾞ（Enzeco Neutral Bacterial Protease 2X、Enzyme Development Corp）	0.01-1	0.15	風味生成のために、乳タンパク質をポリペプチド、ペプチド、アミノ酸に加水分解する中性細菌プロテアーゼ
Lactobacillus helveticus（EnzoBact、Medipharm）	0.01-3	0.14	脱苦味剤、アミノペプチダーゼ活性
菌ﾌﾟﾛﾃｱｰｾﾞ（Promod 215、Biocatalysts）	0.01-1	0.28	風味生成のために、乳タンパク質をポリペプチド、ペプチド、アミノ酸に加水分解するタンパク質分解酵素
菌ﾘﾊﾟｰｾﾞ（Lapomod 187、Biocatalysts）	0.01-1	0.12	脂肪を遊離脂肪酸に加水分解し、脂肪分解風味香調を発現するリパーゼ酵素
ソルビン酸	0.01-0.5	0.1	カビ阻害剤

[0067]In order to prevent a reaction mixture serving as non-mind preferably and to provide good mixing, fermentation is carried out where a shearing pump is used and recycled. An enzyme is inactivated after fermentation by applying heat (generally for [about 185 Fahrenheit (about 85 **)] about 30 minutes). Preferably, between heating inactivation processes, although the recirculation is continued, a shearing pump is not used. The desirable cheese-head ingredient prepared using the ingredient of an above-mentioned table has the improved flavor characteristic (namely, "sharp taste" of a stronger cheese head) compared with the similar ingredient generally prepared using the specific starting material and procedure which were indicated to simultaneous pendency U.S. patent application 09th / No. 141082.

[0068]The generated cheese-head ingredient which is produced as a result is the fluid or paste which has a hygroscopic-surface-moisture content of about 53 to about 65% of range preferably about 70% from about 50% typically. Without not adding supporting materials, such as a whey concentrate or malto dextrin, or adding them, spray drying of this cheese-head ingredient can be carried out, and it can provide powder. Generally this cheese-head ingredient has the flavor characteristic / profile shown in Table 8. It seems that it is not detected and that this cheese-head ingredient contains other aroma or flavor compounds which have effect.

[0069]

[Table 8]

チーズ成分の典型的な風味プロファイル

	範囲	典型量
ｹﾞﾙﾌﾟﾛﾌｧｲﾙ	9-34 k (100%)	9-11 k (100%)
ﾌﾟﾛﾃｱｰｾﾞ活性	4-25 FL強度 単位/分/g	9.66 FL強度 単位/分/g
酢酸	10-100 ppm	35 ppm
ﾌﾟﾛﾋﾟｵﾝ酸	<25 ppm-100	<100 ppm
酪酸	2000-7000 ppm	5823 ppm
ﾍｷｻﾝ酸	1000-5000 ppm	3254 ppm
ｵｸﾀﾝ酸	1000-4000 ppm	2922 ppm
ﾃﾞｶﾝ酸	4000-10000 ppm	5230 ppm
ﾄﾞﾃﾞｶﾝ酸	4000-10000 ppm	7145 ppm

[0070]Although the following examples illustrate the various features of this invention further, they do not limit the range of this invention stated to the attached claim in any points. As long as there are no special directions, all the percents and ratios are based on weight. Let all the references that made reference on these specifications be the parts of this specification by reference.

[0071]Example 1 this example illustrates preparation of a sulfur Cheddar ingredient. It doubled with fresh cream in sufficient quantity to obtain the standardization milk which has about 54% of fat content for fresh whole milk based on a dry substance. This standardization milk was pasteurized at low temperature by 164 Fahrenheit (about 73 **) for 16 seconds by the high-temperature-heat exchanger (HTST), and it cooled to 130 Fahrenheit (about 54 **) after that. Next, the cooled milk was condensed 5 times by the swirl type ultrafiltration (UF) system provided with diafiltration (DF), and the lactose content was reduced to about 1%. The UF/DF milk (about 1915 kg (4222 pounds)) which added 2% of salt was heat-treated by 155 Fahrenheit (about 68 **) for 10 minutes by the stirring jacketed vessel, and it cooled to 78 Fahrenheit (about 26 **) after that. This milk concentrate contained 41.8% of solid content, 22.6% of a fat, and 15.4% of protein, and had pH 6.4.

[0072]Lactic acid starter culture (0.01%) [Lactococcus lactis and] And Lactococcus lactis subspecies cremoris, R603, Micrococcus (0.001%), and rumina esterase (0.02%) of Chr.Hansens Inc. were added to the milk concentrate, it fermented in 75 Fahrenheit (about 24 **) in the 1st step for 17 hours, and pH amounted to 5.16. L-methionine (0.1%), L-glutathione (0.1%), and the activation culture (1%) of Brevibacterium linens were added to the 1st-step fermentation output, and the 2nd step of the fermentation process was started. Before use, under the aerobic condition, Brevibacterium linens culture is 75 Fahrenheit (about 24 **), and was activated in trypsin soybean culture medium (TSB) for 48 hours. The 2nd-step fermentation was continued in the state of aeration for seven more days at the temperature of 72 Fahrenheit (about 22 **). pH at the time of the 2nd-step end was 6.75. The quantity of the sulfur compound (namely, methanethiol, dimethyl disulfide, and dimethyl trisulfide) increased dramatically among the fermentation process (see the result of Table 4). In order to inactivate

culture and an enzyme for the sulfur Cheddar ingredient produced as a result and to prolong the storage life of a product, it heated to 155 Fahrenheit (about 68 **) for 10 minutes. The loss of the comparatively small sulfur compound was accepted in this inactivation step. The flavor profile of the sulfur Cheddar ingredient produced as a result is indicated in the paragraph of "the amount of types" in the above-mentioned table 4. This sulfur Cheddar ingredient had about 41% of the total solid content, and when it was a request, spray drying of it was able to be carried out and it was able to form sulfur Cheddar flavor powder.

[0073]Example 2 this example illustrates preparation of a cream butter ingredient. The milk concentrate similar to what was prepared in Example 1 was used as a start substrate.

[0074]Lactic acid starter culture (0.01%) [Lactococcus lactis and] And R603 of Lactococcus lactis subspecies cremoris and Chr.Hansens Inc. and rumina esterase (0.02%) were added to the milk concentrate, it fermented in 75 Fahrenheit (about 24 **) in the 1st step for 17 hours, and pH amounted to 5.16. Sodium acid citrate after heating to 82 Fahrenheit (about 28 **) (0.2%), And Leuconostoc (0.1%) and the activation culture of the Lactococcus lactis subspecies lactis biovar diacetylactic (0.1%) were added to the 1st-step fermentation output, and the 2nd step of the fermentation process was started. Before use, Leuconostoc and Lactococcus lactis subspecies lactis biovar diacetylactic culture are 75 Fahrenheit (about 24 **), and were activated in MRS culture medium overnight. The 2nd-step fermentation was continued in the state of aeration for six more days at the temperature of 82 Fahrenheit (about 28 **). pH at the time of the 2nd-step end was 5.26. The quantity of diacetyl rose to about 176 ppm from about 1 ppm of an initial value to the time of the 2nd-step end. In order to inactivate culture and an enzyme for the cream butter ingredient produced as a result and to prolong the storage life of a product, it heated to 155 Fahrenheit (about 68 **) for 10 minutes. The loss of comparatively small diacetyl was accepted in this inactivation step. The flavor profile of the cream butter ingredient produced as a result is indicated in the paragraph of "the amount of types" in the above-mentioned table 6. This cream butter ingredient had about 42% of the total solid content, and when it was a request, spray drying of it was able to be carried out and it was able to form cream butter flavor powder.

[0075]Example 3 this example illustrates preparation of a cheese-head ingredient. The milk concentrate was prepared using milk protein concentration (MPC) powder, water, anhydrous milk fat, and a salt.

[0076]MPC powder and a salt were hydrated using warm water by the VacuumCam Injection mixer, and the protein slurry was formed. The protein slurry was moved to the stirring jacketed vessel which carried out continuation recycle using the shearing pump. Next, the fused anhydrous milk fat was added and the milk concentrate was formed. The milk concentrate produced as a result contained 43.5% of solid content, 18.6% of fat, 13.7% of protein, and lactose 2.8%, and 1.85% of a salt.

[0077]Among the fermentation process, the milk concentrate was maintained to the same stirring jacketed vessel, where continuation recycle is carried out using a shearing pump. Phosphoric acid 1 sodium (0.5%) was added, and the slurry was heated by 162 Fahrenheit (about 72 **) for 15 minutes. Neutral bacterial protease after cooling to 104 Fahrenheit (about 40 **) (about 0.18%) Enzeco Neutral Bacterial Protease 2X, Enzyme Development Corp., Lactobacillus helveticus (about 0.14%) EnzoBact, Medipharm, bacillus protease (about 0.28% and Promod 215, Biocatalysts), and the enzyme slurry containing bacillus lipase (about 0.28% and Lipomod 187, Biocatalysts) were added. Percent is based on the gross weight of a fermentative mixture. Where it used the shearing pump and continuation stirring and the recirculation are carried out, it continued, in order to maintain an emulsion, and fermentation was continued by 104 Fahrenheit (about 40 **) for 48 hours. After completing fermentation, the enzyme was inactivated by heating to about 185 Fahrenheit (about 85 **) for 30 minutes. During inactivation, although aeration was continued, the shearing pump was not used. The flavor profile of the cheese-head ingredient produced as a result is indicated in the paragraph of "the amount of types" in the above-mentioned table 8. Next, sorbic acid (about 0.1%) was added. This cheese-head ingredient had about 43% of the total solid content, and when it was a request, spray drying of it was able to be carried out and it was able to form cheese-head flavor powder.

[0078]About 15.4 kg (34 pounds) (3.5% of butterfat) of example 4 milk and 0.75 ml of ANATO colorant of double intensity were added to the small cheese vat at the temperature of 88 Fahrenheit (about 31 **). The freezing pellet type starter culture (2.45 g, Chr.Hansens Inc.) was added, and this mixture was ripened for 30 minutes. Flavor constitutional unit material (namely, sulfur Cheddar, the cream butter, the cheese-head ingredient which were generated in Examples 1, 2, and 3, respectively the ratio of 1:1:1, the total amount of 30g) was mixed for aging milk. Next, it was made to solidify for 30 minutes, without adding rennet (1.7 ml, Chymax Extra, Chr.Hansens Inc.), and stirring the produced mixture. Next, the coagulation card was cut on about 0.95 cm (3/8 inch) cube, and was settled for 15 minutes. The card was stirred calmly by hand, applying for 30 minutes and raising temperature to 102 Fahrenheit (about 39 **) after a quiescent period. The card was cooked by 102 Fahrenheit (about 39 **) for 1 hour, and the effluent of the whey was carried out from the card in this time. The solid lump was made to unite a card and it was reversed every 15 minutes for 90 minutes. The small slab produced as a result was milled to an about 1.27x1.27x5.08 cm (1/2x1 / 2x2 inches) wafer. The interval of 5 minutes was kept between each addition, and the salt was added 3 times (12.9g / addition). The produced salting card was put into the small cheese hoop, and was pressurized overnight. After application of pressure, the cheese head was put into the vacuum chamber and pressurized for further 1 hour. The cheese head pressurized thoroughly carried out vacuum enclosure to evaluation at the plastic. It is the same method about a contrast cheese head,

however prepared, without including flavor constitutional unit material. The cheese head prepared using flavor constitutional unit material provided good flavor and sensuous characteristic.

[0079]About 15.4 kg (34 pounds) (3.5% of butterfat) of example 5 milk and 0.75 ml of ANATO colorant of double intensity were added to the small cheese vat at the temperature of 88 Fahrenheit (about 31 **). The freezing pellet type starter culture (2.45 g, Chr.Hansens Inc.) was added, and this mixture was ripened for 30 minutes. Next, it was made to solidify for 30 minutes, without adding rennet (1.7 ml, Chymax Extra, Chr.HansensInc.), and stirring the produced mixture. Next, the coagulation card was cut on about 0.95 cm (3/8 inch) cube, and was settled for 15 minutes. The card was stirred calmly by hand, applying for 30 minutes and raising temperature to 102 Fahrenheit (about 39 **) after a quiescent period. The card was cooked by 102 Fahrenheit (about 39 **) for 1 hour, and the effluent of the whey was carried out from the card in this time. The solid lump was made to unite a card and it was reversed every 15 minutes for 90 minutes. The small slab produced as a result was milled to an about 1.27x1.27x5.08 cm (1/2x1 / 2x2 inches) wafer. A freeze-dried flavor constitutional unit material (namely, sulfur Cheddar, the cream butter, the cheese-head ingredient which were generated in Examples 1, 2, and 3, respectively the ratio of 1:1:1, the total amount of 30g) was mixed with 38.9 g of salts, and it divided into three portions after that. The interval of 5 minutes was kept between each addition, and the mixture of constitutional unit material and a salt was added 3 times (22.9g / addition). The produced salting card was put into the small cheese hoop, and was pressurized overnight. After application of pressure, the cheese head was put into the vacuum chamber and pressurized for further 1 hour. The cheese head pressurized thoroughly carried out vacuum enclosure to evaluation at the plastic. It is the same method about a contrast cheese head, however prepared, without including flavor constitutional unit material. The cheese head prepared using flavor constitutional unit material provided good flavor and sensuous characteristic.

[0080]The lump of the pasteurization process cheese spread which has the sharp Ajika tone of the Cheddar style was prepared using the sulfur Cheddar taste component prepared in example 6 Example 1, the cream butter flavor ingredient prepared in Example 2, and the cheese-head taste component prepared in Example 3. About 1% of the sulfur Cheddar taste component, about 4% of the cream butter flavor ingredient, and about 1% of the cheese-head ingredient were added into the mixture of the young cheese head and the mild cheese head. Next, other ingredients were added in the following quantity.

[0081]whey powder <1% milk protein concentrate [ ] -- < -- 1% sorbic acid <0.5% cheese-head colorant <0.5% phosphoric acid 1 sodium and phosphoric acid disodium [ ] -3% [0082]The cheese-head mixture produced as a result was processed by 175 Fahrenheit (about 79 **) by the Damrow lei down open steam introduction cooker (Damrow Co.Inc., the Wisconsin fondu

rack). The cheese head which carried out heat melting was fabricated in about 0.9 kg (2 pounds) lump, and it cooled to 40 Fahrenheit (about 4 **) with the air-cooling-with-blower machine. The lump of the obtained pasteurization process cheese spread had flavor similar to the preparation cheese products made using the aging cheddar cheese, textures, and melting nature.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a figure which illustrates preparation of the culture cheese-head concentrate containing the sulfur Cheddar taste component, cream butter flavor ingredient, and cheese-head taste component of this invention.

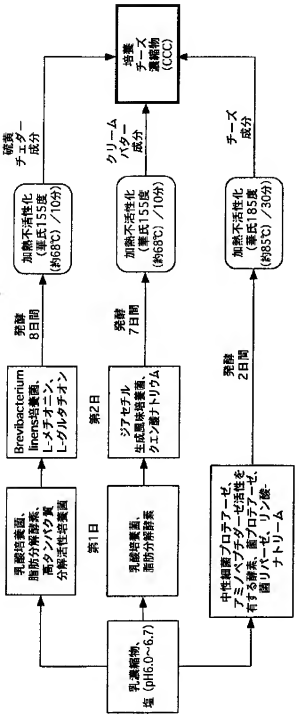
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

[Drawing 1]



[Translation done.]

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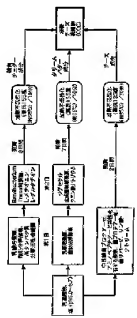
最終頁に続く

(54)【発明の名称】　天然生物生成チーズ風味系

(57)【要約】
【課題】　所望の風味プロファイルを有する非常に異なるチーズを調製するために用いることのできる天然生物生成チーズ風味系を提供すること。
【解決手段】　より詳細には、本発明のチーズ風味系は、硫黄チェダー風味成分、クリームバター風味成分、およびチーズ風味成分を含む。これらの各風味成分は、それぞれ特定の風味プロファイルおよび／または風味特性を備えた風味構成単位として用いることができる。これらの風味成分の様々な組合せを用いることによって、多様な風味を有するチーズを製造することができる。これらの風味成分は、特定の風味プロファイルおよび／または風味特性を有する風味成分を提供するように設計された組成物（たとえば、特定の酵素、培養菌、および添加剤）および工程条件を用いて、高度に濃縮された乳基質から別々に調製される。



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【特許請求の範囲】

【請求項１】　食品用の発酵系であって、前記系が、硫黄チェダー風味成分、クリームバター風味成分　およびチーズ風味成分をさみ、

硫黄チェダー風味成分が、第１の乳濃縮物を乳酸培養菌で　約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して約５．４以下のｐＨを有する第１の混合物を得、第１の混合物に硫黄含有基質を添加して第２の混合物を形成し、第２の混合物をＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌　あるいはＤｅｂａｒｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて　それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌または酵母が硫黄含有基質を硫黄含有風味化合物に転換できるように、約３日から約１０日間、華氏約６５度（約１８℃）から華氏約８６度（約３０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の培養菌および酵素を不活性化するのに十分な温度で第３の混合物を処理して硫黄チェダー風味成分を形成することによって調製され、

クリームバター風味成分が　第２の乳濃縮物を乳酸培養菌で　約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して第４の混合物を形成し、第４の混合物にクエン酸ナトリウムを添加して第５の混合物を形成し　第５の混合物をジアセチル生成乳酸培養菌で、約１日から約１０日間、華氏約７０度（約２１℃）から華氏約９０度（約３２℃）で処理して第６の混合物を形成し　第６の混合物中の培養菌および酵素を不活性化するのに十分な温度で第６の混合物を処理してクリームバター風味成分を形成することによって調製され、

チーズ風味成分が、第３の乳濃縮物をリパーゼ　プロテアーゼ　およびペプチダーゼで、約０．５日から約１０日間、華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で処理して第７の混合物を形成し、第７の混合物中の酵素を不活性化するのに十分な温度で第７の混合物を処理してチーズ風味成分を形成することによって調製され、

前記チーズ風味系の硫黄チェダー風味成分、クリームバター風味成分　およびチーズ風味成分を、様々な量で食品に混和して多様な風味を生成できることを特徴とする風味系。

【請求項２】　前記食品がチーズ製品であり、そのチーズ製品を製造するために、チーズまたは乳製品ベースに　前記風味系の硫黄チェダー風味成分、クリームバター風味成分、およびチーズ風味成分が混和されることを特徴とする請求項１に記載の風味系。

【請求項３】　第１の乳濃縮物がさらに、脂肪分解酵素　および高タンパク質分解活性培養菌で処理され、第２の乳濃縮物がさらに、脂肪分解酵素で処理され　硫黄

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チェダー風味成分を調製するためにＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌が用いられることを特徴とする請求項２に記載の風味系。

【請求項４】　硫黄含有基質が、Ｌ－メチオニン、Ｌ－グルタチオン、Ｌ－システイン、またはそれらの混合物であることを特徴とする請求項３に記載の風味系。

【請求項５】　第１の乳濃縮物、第２の乳濃縮物、および第３の乳濃縮物が、限外濾過／ダイアフィルトレーション工程によって調製され　第１の乳濃縮物、第２の乳濃縮物、および第３の乳濃縮物が、独立して、約３０％から約５０％の総固形分量　約５０％から約７０％の湿分量　約１５％から約２７％の脂肪量　約１０％から約２０％のタンパク質量、および約０．５％から約２％のラクトース量、および約１％から約３％の塩量を有することを特徴とする請求項４に記載の風味系。

【請求項６】　硫黄チェダー風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、硫黄チェダー風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、硫黄チェダー風味成分を調製するために用いられる高タンパク質分解活性培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであることを特徴とする請求項４に記載の風味系。

【請求項７】　硫黄チェダー風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ、またはそれらの混合物であり、硫黄チェダー風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、硫黄チェダー風味成分を調製するために用いられる高タンパク質分解活性培養菌が、Ｍｉｃｒｏｃｏｃｃｕｓであることを特徴とする請求項５に記載の風味系。

【請求項８】　クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ、またはそれらの混合物であり、クリームバター風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、クリームバター風味成分を調製するために用いられる高タンパク質分解活性培養菌が、Ｌｅｕｃｏｎｏｓｔｏｃ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種Ｌａｃｔｉｓ次亜種ｄｉａｃｅｙｌａｃｔｉｓ、またはそれらの混合物であることを特徴とする請求項４に記載の風味系。

【請求項９】　クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ、またはそれらの混合物であり、クリームバター風味成分を調製するために用いられる脂肪分解酵素が　前胃エステラーゼであり、クリームバタ

ー風味成分を調製するために用いられるジアセチル生成風味培養菌が、Ｌｅｕｃｏｎｏｓｔｏｃ、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ、またはそれらの混合物であることを特徴とする請求項５に記載の風味系。

【請求項１０】 チーズ風味成分を調製するために用いられるリパーゼが、菌リパーゼであり、チーズ風味成分を調製するために用いられるプロテアーゼが、中性細菌プロテアーゼ、菌プロテアーゼ、またはそれらの混合物であり、チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓ ｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項４に記載の風味系。

【請求項１１】 チーズ風味成分を調製するために用いられるリパーゼが、菌リパーゼであり、チーズ風味成分を調製するために用いられるプロテアーゼが、中性細菌プロテアーゼ、菌プロテアーゼ、またはそれらの混合物であり、チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓ ｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項５に記載の風味系。

【請求項１２】 硫黄チェダー風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、硫黄チェダー風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、硫黄チェダー風味成分を調製するために用いられる高タンパク質分解活性培養菌が、Ｍｉｃｒｏｃｏｃｃｕｓであり、

クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ、またはそれらの混合物であり、クリームバター風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、クリームバター風味成分を調製するために用いられるジアセチル生成風味培養菌が、Ｌｅｕｃｏｎｏｓｔｏｃ、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ、またはそれらの混合物であり、

チーズ風味成分を調製するために用いられるリパーゼが、菌リパーゼであり、チーズ風味成分を調製するために用いられるプロテアーゼが、中性細菌プロテアーゼ、菌プロテアーゼ、またはそれらの混合物であり、チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓ ｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項４に記載の風味系。

【請求項１３】 硫黄チェダー風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、硫黄チェダー風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、硫黄チェダー風味成分を調製するために用いられる高タンパク質分解活性培養菌が、Ｍｉｃｒｏｃｏｃｃｕｓであり、

クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ、またはそれらの混合物であり、クリームバター風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、クリームバター風味成分を調製するために用いられるジアセチル生成風味培養菌が、Ｌｅｕｃｏｎｏｓｔｏｃ、Ｌａｃｔｏｃｏｃｃｕｓ ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ、またはそれらの混合物であり、

チーズ風味成分を調製するために用いられるリパーゼが、菌リパーゼであり、チーズ風味成分を調製するために用いられるプロテアーゼが、中性細菌プロテアーゼ、菌プロテアーゼ、またはそれらの混合物であり、チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓ ｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項５に記載の風味系。

【請求項１４】 硫黄チェダー風味成分を乾燥して粉末硫黄チェダー風味成分を形成し、クリームバター風味成分を乾燥して粉末クリームバター風味成分を形成し、チーズ風味成分を乾燥して粉末チーズ風味成分を形成することを特徴とする請求項４に記載の風味系。

【請求項１５】 硫黄チェダー風味成分を乾燥して粉末硫黄チェダー風味成分を形成し、クリームバター風味成分を乾燥して粉末クリームバター風味成分を形成し、チーズ風味成分を乾燥して粉末チーズ風味成分を形成することを特徴とする請求項５に記載の風味系。

【請求項１６】 硫黄チェダー風味成分を乾燥して粉末硫黄チェダー風味成分を形成し、クリームバター風味成分を乾燥して粉末クリームバター風味成分を形成し、チーズ風味成分を乾燥して粉末チーズ風味成分を形成することを特徴とする請求項１２に記載の風味系。

【請求項１７】 硫黄チェダー風味成分を乾燥して粉末硫黄チェダー風味成分を形成し、クリームバター風味成分を乾燥して粉末クリームバター風味成分を形成し、チーズ風味成分を乾燥して粉末チーズ風味成分を形成することを特徴とする請求項１３に記載の風味系。

【請求項１８】 培養チーズ濃縮物を用いて風味付けチーズを調製する方法であって、前記方法が、

（１）チーズ、または乳製品ベースを調製すること、

（２）約１％から約１０％の培養チーズ濃縮物を、チーズ、または乳製品ベースに混和して風味付けチーズを形成することを含み、

前記培養チーズ濃縮物が、０％から約８０％の硫黄チェダー風味成分、約１０％から約９０％のクリームバター風味成分、および約１０％から約９０％のチーズ風味成

分を含み、
硫黄チェダー風味成分が、第１の乳酸細菌を乳酸培養面で　約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して約５．４以下のｐＨを有する第１の混合物を得、第１の混合物に硫黄含有基質を添加して第２の混合物を形成し、第２の混合物をＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌、あるいはＤｅｂａｒｙｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ酵母菌の群母を用いて　それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌または酵母が硫黄含有基質を硫黄含有風味化合物に転換できるように、約３日から約１０日間、華氏約６５度（約１８℃）から華氏約８６度（約３０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の培養菌および酵素を不活性化するのに十分な温度で第３の混合物を処理して硫黄チェダー風味成分を形成することによって調製され、
クリームバター風味成分が、第２の乳酸細菌を乳酸培養面で、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して第４の混合物を形成し、第４の混合物にクエン酸ナトリウムを添加して第５の混合物を形成し、第５の混合物をジアセチル生成風味培養菌で、約１日から約１０日間、華氏約７０度（約２１℃）から華氏約９０度（約３２℃）で処理して第６の混合物を形成し、第６の混合物中の培養菌および酵素を不活性化するのに十分な温度で第６の混合物を処理してクリームバター風味成分を形成することによって調製され、
チーズ風味成分が、第３の乳酸細菌をリパーゼ　プロテアーゼ、およびペプチダーゼで、約０．５日から約１０日間、華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で処理して第７の混合物を形成し、第７の混合物中の酵素を不活性化するのに十分な温度で第７の混合物を処理してチーズ風味成分を形成することによって調製され、
培養チーズ濃縮物中の硫黄チェダー風味成分、クリームバター風味成分、およびチーズ風味成分の量、ならびにチーズまたは乳製品ベースに添加される培養チーズ濃縮物の量を、多様な風味を有する風味付けチーズを得るために調整できることを特徴とする方法。
【請求項１９】　第１の乳酸細菌がさらに、脂肪分解酵素　および蛋白質分解活性培養菌で処理され、第２の乳酸細菌がさらに、脂肪分解酵素で処理され、硫黄チェダー風味成分を調製するためにＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌が用いられることを特徴とする請求項１８に記載の方法。
【請求項２０】　硫黄含有基質が、Ｌ－メチオニン、Ｌ－グルタチオン、Ｌ－システイン、またはそれらの混合物であることを特徴とする請求項１９に記載の方法。
【請求項２１】　培養チーズ濃縮物が　硫黄チェダー風味成分約２５％から約７５％、クリームバター風味成分約２５％から約７５％、およびチーズ風味成分約２５％から約７５％を含むことを特徴とする請求項１９に記載の方法。
【請求項２２】　硫黄チェダー風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、硫黄チェダー風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、硫黄チェダー風味成分を調製するために用いられる蛋タンパク質分解活性培養菌が、Ｍｉｃｒｏｃｏｃｃｕｓであり、クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ、またはそれらの混合物であり、クリームバター風味成分を調製するために用いられる脂肪分解酵素が、前胃エステラーゼであり、クリームバター風味成分を調製するために用いられるジアセチル生成風味培養菌が、Ｌｅｕｃｏｎｏｓｔｏｃ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種Ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ、またはそれらの混合物であり、チーズ風味成分を調製するために用いられるリパーゼが、菌リパーゼであり、チーズ風味成分を調製するために用いられるプロテアーゼが、中性細菌プロテアーゼ、菌プロテアーゼ、またはそれらの混合物であり、チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓ　ｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項１９に記載の方法。
【請求項２３】　培養チーズ濃縮物が乾燥粉末であることを特徴とする請求項１９に記載の方法。
【請求項２４】　培養チーズ濃縮物が乾燥粉末であることを特徴とする請求項２２に記載の方法。
【請求項２５】　培養チーズ濃縮物を用いて風味付けチーズを調製する方法であって、前記方法が、
（１）チーズの製造に適した乳基質を調製すること、
（２）約１％から約１０％の培養チーズ濃縮物を乳基質に混和すること、
（３）乳基質および培養チーズ濃縮物を処理して乳基質を凝固すること、
（４）凝固乳基質を切断してカードおよびホエーを形成すること、
（５）カードおよびホエーをクッキングすること、
（６）ホエーからカードを分離すること、および
（７）分離したカードから風味付けチーズを形成すること　を含み、
前記培養チーズ濃縮物が、０％から約８０％の硫黄チェダー風味成分　約１０％から約９０％のクリームバター風味成分、および約１０％から約９０％のチーズ風味成分を含み、

硫黄チェダー臭味成分が、第１の乳酸細菌を乳酸培養面で、約１０時間から約２４時間、等氏約７０度（約２１℃）から等氏約８６度（約３０℃）の温度で処理して約５．４以下のｐＨを有する第１の混合物を得、第１の混合物に硫黄含有基質を添加して第２の混合物を形成し、第２の混合物をＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養面、あるいはＤｅｂａｒｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて、それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌またはその硫黄含有基質を硫黄含有風味化合物に転換できるように、約３日から約１０日間、等氏約６５度（約１８℃）から等氏約８６度（約３０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の培養菌および酵素を不活性化するのに十分な温度で第３の混合物を処理して硫黄チェダー風味成分を形成することによって調製され、

クリーム風味成分が、第２の乳酸細菌を乳酸培養面で、約１０時間から約２４時間、等氏約７０度（約２１℃）から等氏約８６度（約３０℃）の温度で処理して第４の混合物を形成し、第４の混合物にクエン酸ナトリウムを添加して第５の混合物を形成し、第５の混合物をジアセチル生成風味培養菌で、約１日から約１０日間、等氏約７０度（約２１℃）から等氏約９０度（約３２℃）で処理して第６の混合物を形成し、第６の混合物中の培養菌および酵素を不活性化するのに十分な温度で第６の混合物を処理してクリーム風味成分を形成することによって調製され

チーズ風味成分が、第３の乳酸細菌をリパーゼ、プロテアーゼ、およびペプチダーゼを用いて、約０．５日から約１０日間、等氏約６０度（約１６℃）から等氏約１４０度（約６０℃）の温度で処理して第７の混合物を形成し、第７の混合物中の酵素を不活性化するのに十分な温度で第７の混合物を処理してチーズ風味成分を形成することによって調製され、

培養チーズ濃縮物の硫黄チェダー風味成分、クリームバター風味成分、およびチーズ風味成分の量、ならびに異種菌に添加される培養チーズ濃縮物の量を、多様な風味を有する風味付けチーズを得るために調整できることを特徴とする方法。

【請求項２６】　第１の乳酸細菌物がさらに、脂肪分解酵素、および高タンパク質分解活性培養菌で処理され、第２の乳酸細菌物がさらに、脂肪分解酵素で処理され、硫黄チェダー風味成分を調製するためにＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌が用いられることを特徴とする請求項２５に記載の方法。

【請求項２７】　硫黄含有基質が、Ｌ－メチオニン、Ｌ－グルタチオン　Ｌ－シスチン、またはそれらの混合物であることを特徴とする請求項２５に記載の方法。

【請求項２８】　培養チーズ濃縮物が、硫黄チェダー風味成分約２５％から約７５％、クリームバター風味成分約２５％から約７５％、およびチーズ風味成分約２５％から約７５％を含むことを特徴とする請求項２５に記載の方法。

【請求項２９】　硫黄チェダー風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、硫黄チェダー風味成分を調製するために用いられる脂肪分解酵素が、酵母エステラーゼであり、硫黄チェダー風味成分を調製するために用いられる高タンパク質分解活性培養菌が、Ｍｉｃｒｏｃｏｃｃｕｓであり、クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ、またはそれらの混合物であり、クリームバター風味成分を調製するために用いられる脂肪分解酵素が、酵母エステラーゼであり、クリームバター風味成分を調製するために用いられるジアセチル生成風味培養菌が、Ｌｅｕｃｏｎｏｓｔｏｃ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種Ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ、またはそれらの混合物であり、チーズ風味成分を調製するために用いられるリパーゼが、酵母リパーゼであり、チーズ風味成分を調製するために用いられるプロテアーゼが、中性細菌プロテアーゼ、酵プロテアーゼ　またはそれらの混合物であり、チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓ　ｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項２７に記載の方法。

【請求項３０】　培養チーズ濃縮物が乾燥粉末であることを特徴とする請求項２７に記載の方法。

【請求項３１】　培養チーズ濃縮物が乾燥粉末であることを特徴とする請求項２９に記載の方法。

【請求項３２】　チーズの風味付けに用いるための硫黄チェダー風味成分であって　前記硫黄チェダー風味成分が　乳酸細菌物を乳酸培養菌で、約１０時間から約２４時間　等氏約７０度（約２１℃）から等氏約８６度（約３０℃）の温度で処理して約５．４以下のｐＨを有する第１の混合物を得　第１の混合物に硫黄含有基質を添加して第２の混合物を形成し　第２の混合物をＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌、あるいはＤｅｂａｒｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて、それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌または酵母が硫黄含有基質を硫黄含有風味化合物に転換できるように、約３日から約１０日間　等氏約６５度（約１８℃）から等氏約８６度（約３０℃）の温度で処理して第３の混合物を形成し　第３の混合物中の酵素を不活性化するのに十分な温度で第３の混合物を処理して硫黄チェダー風味成分を形成することによって調製されることを特徴とする硫黄チェダー風味成分。

【請求項３３】　乳濃縮物がさらに、脂肪分解酵素、および高タンパク質分解活性培養菌で処理され、硫黄チェダー風味成分を調製するために、Ｂｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌が用いられることを特徴とする請求項３２に記載の硫黄チェダー風味成分。

【請求項３４】　硫黄含有基質が、Ｌ－メチオニン、Ｌ－グルタチオン、Ｌ－システィン、またはそれらの混合物であることを特徴とする請求項３３に記載の硫黄チェダー風味成分。

【請求項３５】　乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、脂肪分解酵素が、前胃エステラーゼであり、高タンパク質分解活性培養菌が、Ｍｉｃｒｏｃｏｃｃｕｓであることを特徴とする請求項３４に記載の硫黄チェダー風味成分。

【請求項３６】　硫黄チェダー風味成分が乾燥粉末であることを特徴とする請求項３３に記載の硫黄チェダー風味成分。

【請求項３７】　硫黄チェダー風味成分が乾燥粉末であることを特徴とする請求項３４に記載の硫黄チェダー風味成分。

【請求項３８】　食品用の風味系であって、前記系が、硫黄チェダー風味成分、クリームバター風味成分、およびチーズ風味成分を含み

硫黄チェダー風味成分が、第１の乳濃縮物を乳酸培養菌　硫黄含有基質、およびＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌　あるいはＤｅｂａｒｏｍｙｃｅｓまたはＬｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて、それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌または酵母が硫黄含有基質を嫌気含有風味化合物に転換できるように、約３日から約１０日間、華氏約６５度（約１８℃）から華氏約８６度（約３０℃）の温度で処理して第１の混合物を形成し、第１の混合物中の培養菌および酵素を不活性化するのに十分な温度で第１の混合物を処理して硫黄チェダー風味成分を形成することによって調製され、

クリームバター風味成分が、第２の乳濃縮物を乳酸培養菌　ジアセチル生成風味培養菌、およびクエン酸ナトリウムで、約１日から約１０日間、華氏約７０度（約２１℃）から華氏約９０度（約３２℃）の温度で処理して第２の混合物を形成し、第２の混合物中の培養菌および酵素を不活性化するのに十分な温度で第２の混合物を処理してクリームバター風味成分を形成することによって調製され、

チーズ風味成分が、第３の乳濃縮物をリパーゼ　プロテアーゼ、およびペプチダーゼで、約０．５日から約１０日間　華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の酵素を不活性化するのに十分な温度で第３の混合物を処理してチーズ風味成分を形成することによって調製され、

前記チーズ風味系の硫黄チェダー風味成分、クリームバター風味成分　およびチーズ風味成分を、様々な量で食品に混和して多様な風味を生成できることを特徴とする風味系。

【請求項３９】　前記食品がチーズ製品であり、そのチーズ製品を製造するために、チーズまたは乳製品ベースに　前記風味系の硫黄チェダー風味成分、クリームバター風味成分、およびチーズ風味成分が混和されることを特徴とする請求項３８に記載の風味系。

【請求項４０】　第１の乳濃縮物がさらに、脂肪分解酵素、および高タンパク質分解活性培養菌で処理され、第２の乳濃縮物がさらに、脂肪分解酵素で処理され、硫黄チェダー風味成分を調製するためにＢｒｅｖｉｂａｃｔｅｒｉｕｍｌｉｎｅｎｓ培養菌が用いられることを特徴とする請求項３９に記載の風味系。

【請求項４１】　硫黄含有基質が、Ｌ－メチオニン、Ｌ－グルタチオン、Ｌ－システィン、またはそれらの混合物であることを特徴とする請求項４０に記載の風味系。

【請求項４２】　硫黄チェダー風味成分を調製するために用いられる乳酸培養菌が　Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ，Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ，またはそれらの混合物であり、クリームバター風味成分を調製するために用いられるジアセチル生成風味培養菌が、Ｌｅｕｃｏｎｏｓｔｏｃ、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ，またはそれらの混合物であり、チーズ風味成分を調製するために用いられるリパーゼが、豆リパーゼであり、チーズ風味成分を調製するために用いられるプロアーゼが、中性細菌プロテアーゼ、酒プロアーゼ、またはそれらの混合物であり、チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項３９に記載の風味系。

【請求項４３】　硫黄チェダー風味成分を調製するために用いられる乳酸培養菌が　Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、硫黄チェダー風味成分を調製するために用いられる脂肪分解酵素が　前胃エステラーゼであり、硫黄チェダー風味成分を調製するために用いられる高タンパク質分解活性培養菌が　Ｍｉｃｒｏｃｏｃｃｕｓであり、クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ，Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ，またはそれらの混合物であり、クリームバター風味成分を調製するために用

いられる脂肪分解酵素が　前胃エステラーゼであり、クリームバター風味成分を調製するために用いられるジアセチル生成風味培養菌が　Ｌｅｕｃｏｎｏｓｔｏｃ，Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ，またはそれらの混合物であり、チーズ風味成分を調製するために用いられるリパーゼが、菌リパーゼであり、チーズ風味成分を調製するために用いられるプロテアーゼが、中性繊菌プロテアーゼ、菌プロテアーゼ　またはそれらの混合物であり、チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓ　ｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項４０に記載の風味系。

【請求項４４】　硫黄チェダー風味成分を調製するために用いられる風味培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ　およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓであり、硫黄チェダー風味成分を調製するために用いられる脂肪分解酵素が、膵臓エステラーゼであり、硫黄チェダー風味成分を調製するために用いられる高タンパク質分解活性培養菌が、Ｍｉｃｒｏｃｏｃｃｕｓであり　クリームバター風味成分を調製するために用いられる乳酸培養菌が、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ，Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ，またはそれらの混合物であり、クリームバター風味成分を調製するために用いられる脂肪分解酵素が　前胃エステラーゼであり、クリームバター風味成分を調製するために用いられるジアセチル生成風味培養菌が、Ｌｅｕｃｏｎｏｓｔｏｃ，Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ，またはそれらの混合物であり、チーズ風味成分を調製するために用いられるリパーゼが　菌リパーゼであり、チーズ風味成分を調製するために用いられるプロテアーゼが、中性繊菌プロテアーゼ、菌プロテアーゼ，またはそれらの混合物であり　チーズ風味成分を調製するために用いられるペプチダーゼが、Ｌａｃｔｏｂａｃｉｌｌｕｓ　ｈｅｌｖｅｔｉｃｕｓ由来であることを特徴とする請求項４１に記載の風味系。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、一般に所望の風味プロファイルを有する非常に異なるチーズを調製するために用いることのできる天然生物生成チーズ風味系に関する。より詳細には、本発明は、硫黄チェダー風味成分　クリームバター風味成分、およびチーズ風味成分を含む天然生物生成チーズ風味系に関する。これらの各風味成分は、それぞれ特定の風味プロファイルおよび／または風味特性を備えた風味構成単位として用いることができる。これらの風味成分の様々な組合せを用いることによって、多様な風味を有するチーズを容易に調製することができる。これらの風味成分は　特定の風味プロファイルおよび／または風味特性を有する風味成分を提供するように設計された成分（たとえば　特定の酵素、熔着菌　および添加剤）および工程条件を用いて、高度に濃縮された乳製脂肪から別々に調製される。これらの風味成分は、所望の風味プロファイルを備えた非常に異なるチーズを製造するために、プロセスチーズ、ナチュラルチーズ、または他のチーズに用いることができる。この風味濃縮物は　他の食品に天然風味系として用いることもできる。

【０００２】

【従来の技術】ナチュラルチーズは、一般に、乳に酸度を発現させ、レンネットなどの凝固剤で乳を凝固することによって、またはタンパク質の等電点まで酸度を発現させることによって作られる。この凝固乳を切断し、生じるカードからホエーを分離する。カードを加圧し、チーズブロックを提供することができる。硬化は典型的に、制御条件下で非常に長い時間をかけて行われる。たとえば、チェダーチーズは少なくとも４カ月間硬化し、チェダーチーズに所望の十分な風味を得るために、１年を超える期間硬化してもよい。

【０００３】ナチュラルチーズを特徴し、乳化塩と共に加熱することによって、ナチュラルチーズのいくつかの特性を有する製品が提供されることはよく知られている。結果として生じる製品に与えられる名称に用いられた成分およびその組成によって決まり　場合によっては、米国食品医薬品局２１ＣＦＲ１３３項１６９～１８０に公表された規制基準によって決定される。たとえば　「低温殺菌プロセスチーズ」という用語は、乳化剤、通例は乳化塩、および場合によっては脂肪添加され、次に均質な塑性物質に加工、加熱されたチーズ配合物を含む製品を指す。プロセスチーズの風味は、長期間保持した（４カ月超経過した）ナチュラルチーズを高い割合で用いることに依存している。長期間保持したチーズの使用は、貯蔵、保管費用のために　プロセスチーズのコストを増大させる。通常の方法によって製造されるナチュラルチーズの収量は比較的低く　一般に乳約４５．３６ｋｇ（１００ポンド）当たり　チーズ約４．５４～５．４４ｋｇ（約１０～１２ポンド）が製造される。これもコストを増大させる。

【０００４】「低温殺菌プロセスチーズ食品」という用語は　プロセスチーズの製造に用いられるのと同一の材料および同一の方法から調製される製品を指す。しかしながらそのようなチーズ食品には、一般に、クリーム、乳、脱脂乳、ホエー、またはそれらのいずれかから水の一部を除去したもの（たとえば、濃縮脱脂乳）など、乳製品成分が添加されている。プロセスチーズ食品の脂肪量は　一般にプロセスチーズより高く　約４４％までであることができる。脂肪は、一般に２３％以上の量で存在する。

【０００５】「低温殺菌プロセスチーズスプレッド」という用語は、示した乳製品成分を含有できるという点においてチーズ食品に類似の製品を指す。しかしながらプロセスチーズスプレッドは、６０％程度の高い湿分量、および２０％の最低脂肪量を有することが必要である。

【０００６】プロセスチーズ、プロセスチーズ食品、およびプロセスチーズスプレッドは、それらの製造方法および組成がＦｅｄｅｒａｌ　Ｓｔａｎｄａｒｄｓ　ｏｆ　Ｉｄｅｎｔｉｔｙによって決められているので「標準化製品」と呼ばれる。

【０００７】本明細書では、「プロセスチーズタイプ製品」という用語は、「低温殺菌プロセスチーズ」、「低温殺菌プロセスチーズ食品」、「低温殺菌プロセスチーズスプレッド」、および「低温殺菌プロセスチーズ製品」として知られ、そのように呼ばれる製品が含まれる。「プロセスチーズタイプ製品」はさらに、プロセスチーズ、プロセスチーズ食品、プロセスチーズスプレッド、およびプロセスチーズ製品に類似しているが、植物油または植物タンパク質など、米国Ｆｅｄｅｒａｌ　Ｓｔａｎｄａｒｄｓ　ｏｆ　Ｉｄｅｎｔｉｔｙに指定されていない成分を含有する、あるいはそのような基準の組成要件を満たさない可能性があるという点において、上述のいずれかの製品に関する基準を満たさない可能性のある製品を含む。プロセスチーズタイプ製品はさらに、用いられた成分または製造段階に関わらず、かつ基準を満たしているかどうかに関わらず、プロセスチーズタイプ製品に類似した風味、および質感を有する製品を含む。

【０００８】プロセスチーズに用いることのできる、天然由来の強く風味付けされたチーズ成分を、短い期間で生成するために多くの努力がなされてきた。たとえば、米国特許第４７５２４８３号は、強く風味付けされたチーズ成分を生成する方法を対象としている。この方法においては、まずチーズカードを生成し、結果として生じる「グリーン」チェダータイプチーズカードを粉砕し、次にプロテアーゼ、リパーゼ、および水と合わせ、約５日から６日間インキュベートする。「グリーン」チェダータイプチーズカードという用語は、約６０日未満熟成したチェダーチーズを指す。

【０００９】米国特許第４１７２９００号は、プロセスチーズの調製に用いるために適応させた著しく増強したアメリカンチーズ風味を有するナチュラルチーズ製品を製造することを対象としている。この方法においては、乳から凝塊を製造し、凝塊を切断してカードとホエーを形成し、このホエーを精製してチーズカードを形成する通常の方法でチーズカードを生成する。カードの粒子を生成し、塩、脂肪分解酵素源、およびタンパク質分解酵素源と混合し、通常のアメリカンタイプチーズに比べて増大した量のＣ３～Ｃ８脂肪酸を生成するのに十分な期間硬化する。

【００１０】米国特許第４１１９７３２号は、通常にチーズを製造する方法を対象としている。この方法においては、レンネット、チヤモザリバーゼ、および予ウシリパーゼを、発酵期間中に乳に混合する。次にこの乳を凝固し、カード粒子に切断し、続いてホエーの排液段階を含むチェダーチーズを製造する通常の手順によって処理する。このカードをチーズブロックに形成し、チーズブロックを約１０℃前熱成して、強度に熟成されたチェダーチーズ風味を提供する。

【００１１】米国特許第３９７５５４４号は、チーズブロックの硬化期間を実質的に短縮するために酵素混合物をチェダリングカードに添加する、低温殺菌乳からチェダーチーズを製造する方法を記載している。このチーズブロックは、１０℃から２５℃で１カ月間硬化する。

【００１２】米国特許第４２４４９７１号は、チーズ製品を迅速に製造する方法を対象としている。この方法においては、熔着チーズ成分は、乳タンパク質をタンパク分解し、乳脂肪を脂肪分解し、これらの加水分解材料の混合乳酸物を形成することによって調製される。この混合乳酸物をチーズスターターカルチャーと合わせ、発酵させて熔着チーズの成分を提供する。次に熔着チーズ成分を、乳タンパク質誘導物、および脂肪誘導物と混合する。この混合物を発酵して、通常のチーズクッキング技法によってプロセスチーズタイプ製品を作ることのできるチーズ材料を提供する。

【００１３】１９９９年５月１９日に出願され、本出願と同一の譲受人が所有している、同時係属米国特許出願第０９／３１４７１３号は、タンパク質分解酵素を用いた処理が加熱段階の前に行われ、この酵素処理が比較的短時間である（すなわち、通例約１２時間未満）、酵素変性チーズ風味料を製造する方法を提供した。この方法には、（ｉ）ホエータンパク質を含有する乳製品の液体をタンパク質分解酵素と接触させて乳製品反応混合物を提供する段階、（ｉｉ）タンパク質を部分的に加水分解するのに十分な期間、十分な濃度で乳製品反応混合物をインキュベートする段階、（ｉｉｉ）部分的に加水分解された乳製品反応混合物を低温殺菌する段階、（ｉｖ）低温殺菌混合物を、リパーゼおよびチーズ培養菌を含む凝塊物と接触させ、チーズ風味を発現するのに十分な時間、十分な濃度でインキュベートする段階、および（ｖ）培養菌を不活性化し、微生物不純物を死滅させ、酵素を不活性化するのに十分な熱で混合物を処理する段階が含まれ、それによって酵素変性チーズ風味料が提供された。

【００１４】１９９８年８月２７日に出願され、本出願と同一の譲受人が所有している、同時係属米国特許出願第０９／１４１０８２号は、本エー排液段階を用いることなく、またはチーズカードを生成することなく、短期間でチーズを製造するのに用いる強く風味付けされた成分を調製する方法を提供した。乾燥または濃縮タンパク

質源　脂肪源　脂源、および水を合わせて混合することによって、チーズ風味前駆物質（すなわち、水性　酸性化タンパク質　および脂肪質）が調製された。次にこの基質に酵素系を添加した。酵素系には、リパーゼ、プロテアーゼ、およびペプチダーゼが含まれた。次に、基質中に著しく発現したチーズ風味を提供するのに十分な時間、この基質を発酵した。その後、基質を酵素系を不活性化するのに十分な温度に加熱し、十分な時間その温度で保持した。

【００１５】これらの方法は、一般に強く風味付けされたチーズ成分を提供するが、一般に単一の標準の風味付けチーズを製造するのに適した風味プロファイルに限られている。したがって、これらの方法を用いて　大きく異なる所望の風味プロファイルを有するチーズを製造することはできない。さらに、これらの方法はいずれも、シャープなチェダー香調を有する、またはそれを与える強く風味付けされたチーズ成分を生成しない。

【００１６】

【発明が解決しようとする課題】したがって、所望の広く異なる風味プロファイルを有するチーズをそれによって調製することのできるチーズ風味系を提供することが望ましい。さらに、少数の風味成分だけを用いて、多様な所望の風味付けチーズを調製することのできるチーズ風味系を提供することが望ましい。さらに、シャープなチェダー香調を有する強く風味付けされたチーズ成分を提供することが望ましい。本発明は、そのようなチーズ風味系、およびシャープなチェダー香調を有する、またはそれを与える強く風味付けされたチーズ成分を提供する。

【００１７】

【課題を解決するための手段】本発明は、一般に、所望の風味プロファイルを有するチーズを調製するために用いることのできる天然発生生成チーズ風味系に関する。より詳細には　本発明は　「硫黄チェダー」風味成分、「クリームバター」風味成分、および「チーズ」風味成分を含むチーズ風味系に関する。これらの各風味成分は　それぞれ特定の風味プロファイルおよび／または風味特性を備えた風味様成単位として用いることができる。これらの風味成分の様々な組合せ（すなわち　本発明の培養チーズ濃縮物）を用いることによって　多様な風味を有するチーズを製造することができる。これらの風味濃縮物は　特定の風味プロファイルおよび／または風味特性を有する風味成分を提供するように設計された酵素　培養菌　添加剤、および工程条件を用いて、高度に濃縮された乳基質から別々に調製される。これらの風味濃縮物は、所望の風味プロファイルを備えたプロセスチーズ、または他のチーズを調製するために用いることができる。この風味濃縮物は、チーズを製造するために用いられる乳基質に添加することができ、その後、乳基質は所望のチーズを製造するために処理される。別法として　所望のチーズを製造するために　この風味濃縮物を　チーズまたは乳製品ベース（すなわち、所望の風味プロファイルを持たないチーズカードおよび／または乳製品固形分）に添加することができる。この風味濃縮物は　他の食品に天然風味系として用いることもできる。

【００１８】本発明は、硫黄チェダー風味成分　クリームバター風味成分、およびチーズ風味成分を含む風味系を提供し、硫黄チェダー風味成分は、第１の乳濃縮物　を　乳酸培養菌　ならびに任意選択で脂肪分解酵素および高タンパク質分解活性培養菌で、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して約５．４以下のｐＨを有する第１の混合物を得、第１の混合物に硫黄含有基質を添加して第２の混合物を形成し、第２の混合物を　Ｂｒｅｖｉｂａｃｔｅｒｉｕｍｌｉｎｅｎｓ培養菌、あるいは　Ｄｅｂａｒｏｍｙｃｅｓまたは　Ｋｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて　それによって　Ｂｒｅｖｉｂａｃｔｅｒｉｕｍｌｉｎｅｎｓ培養菌または酵母が硫黄含有基質を硫黄含有風味化合物に転換できるように　約３日から約１０日間、華氏約６５度（約１８℃）から華氏約８６度（約３０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の培養菌および酵素を不活性化するのに十分な温度で第３の混合物を処理して硫黄チェダー風味成分を形成することによって調製され、クリームバター風味成分は、第２の乳濃縮物を、乳酸培養菌、および任意選択で脂肪分解酵素を用いて、約１０時間から約２４時間　華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して第４の混合物を形成し、第４の混合物にクエン酸ナトリウムを添加して第５の混合物を形成し、第５の混合物をジアセチル生成風味培養菌で、約１日から約１０日間、華氏約７０度（約２１℃）から華氏約９０度（約３２℃）で処理して第６の混合物を形成し、第６の混合物中の培養菌および酵素を不活性化するのに十分な温度で第６の混合物を処理してクリームバター風味成分を形成することによって調製され、チーズ風味成分は、第３の乳濃縮物を、リパーゼ、プロテアーゼ　およびペプチダーゼを用いて、約０．５日から約１０日間、華氏約８６度（約１６℃）から華氏約１４０度（約６０℃）の温度で処理して第７の混合物を形成し、第７の混合物中の酵素を不活性化するのに十分な温度で第７の混合物を処理してチーズ風味成分を形成することによって調製され、このチーズ風味系の硫黄チェダー風味成分、クリームバター風味成分、およびチーズ風味成分は　様々な量で食品に混和し、多様な風味を生成することができる。本発明の風味系は特に　チーズ製品を製造するために、チーズまたは乳製品ベースに添加することに適合している。

【００１９】本発明はさらに、硫黄チェダー風味成分、クリームバター風味成分　およびチーズ風味成分を含むチーズ風味系を提供し、硫黄チェダー風味成分は　第１

の乳濃縮物を　乳酸培養菌　任意選択で嫌気分解酵素、任意選択で高タンパク質分解活性培養菌、流質含有基質　およびＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌、あるいはＤｅｂａｒｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて、それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌または酵母が嘘質含有基質を流質含有風味化合物に転換できるように、約３日から約１０日間、華氏約６５度（約１８℃）から華氏約８６度（約３０℃）の温度で処理して第１の混合物を形成し、第１の混合物中の培養菌および酵素を不活性化するのに十分な温度で第１の混合物を処理して嘘質チェダー風味成分を形成することによって調製され、クリームバター風味成分は、第２の乳濃縮物を、乳酸培養菌、任意選択で嫌気分解酵素　ジアセチル生成風味培養菌、およびクエン酸ナトリウムを用いて　約１日から約１０日間　華氏約７０度（約２１℃）から華氏約９０度（約３２℃）の温度で処理して第２の混合物を形成し、第２の混合物中の培養菌および酵素を不活性化するのに十分な温度で第２の混合物を処理してクリームバター風味成分を形成することによって調製され　チーズ様風味成分は　第３の乳濃縮物を、リパーゼ　プロテアーゼ、およびペプチダーゼを用いて、約０．５日から約１０日間、華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の酵素を不活性化するのに十分な温度で第３の混合物を処理してチーズ風味成分を形成することによって調製され、このチーズ風味系の嘘質チェダー風味成分、クリームバター風味成分、およびチーズ風味成分は、様々な量でチーズまたは乳製品ベースに混和し、多様な風味を有するチーズを製造することができる。

【００２０】シャープなチェダー風味成分または濃縮物はまた、プロセスチーズの製造において熟成した風味付けチーズを代替するために単独で用いることもできる。このように、本発明はさらに、チーズ製造において用いるためのシャープなチェダー風味成分または濃縮物を生成する方法を提供する。このシャープなチェダー風味成分または濃縮物は、ナチュラルチーズに特定の風味香調を添加、特に、非常に若いチェダーチーズにシャープなチェダー香調を提供するために単独で用いることができる。このように、本発明はさらに、チーズの風味付けに使用するための嘘質チェダー風味成分を提供し　この嘘質チェダー風味成分は　乳濃縮物を　乳酸培養菌、ならびに任意選択で嫌気分解酵素および高タンパク質分解活性培養菌で　約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して約５．４以下のｐＨを有する第１の混合物を形成し　第１の混合物に流質含有基質を添加して第２の混合物を形成し、第２の混合物をＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌、あるいはＤｅｂａｒｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて、それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌または酵母が嘘質含有基質を嘘質含有風味化合物に転換できるように、約３日から約１０日間、華氏約６５度（約１８℃）から華氏約８６度（約３０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の酵素を不活性化するのに十分な温度で第３の混合物を処理して嘘質チェダー風味成分を形成することによって調製される。

【００２１】この方法において、出発原料は、水性タンパク質および脂肪含有混合物を含む乳濃縮物である。この水性の乳由来濃縮物（すなわち、高度に濃縮された乳系）は一般に　総固形分含量約３０％から約５０％、タンパク質含量約１０％から約１９％、脂肪含量約１５％から約３０％、ラクトース含量約０．５％から約１０％を有する。好ましくは、この水性乳由来濃縮物は、総固形分含量約３５％から約４７％、タンパク質含量約１２％から約１７％、脂肪含量約１８％から約２５％、ラクトース含量約０．５％から約５％を有する。好ましくは、この水性乳由来濃縮物または基質は、膜外濾過／ダイアフィルトレーション（ＵＦ／ＤＦ）によって調製された液体乳濃縮物、またはＵＦ／ＤＦ粉乳および乳脂肪の混合物から調製された通元乳基質である。図１に示したように、この液体乳濃縮物を次に３つの部分に分け、特定の風味特性を発現させるのに十分な所定の期間、それぞれを特定の嘘味酵素　培養菌、補助剤、および他の添加剤で処理（すなわち　発酵）する。この方法を用いることによって、「嘘質チェダー」成分、「クリームバター」成分、および「チーズ」成分を生成することができる。次に各部分を、特定の風味成分を調製するために用いた酵素／培養菌系を不活性化するのに十分な温度に加熱し、十分な時間その温度で保持する。一般に、主として便宜上、本発明のチーズ風味系の　３種それぞれの風味成分を調製するために同一または類似の乳濃縮物を用いることが好ましいが、所望であれば、３種それぞれの風味成分を調製するために別々の乳濃縮組成物を用いることができる。

【００２２】嫌熱下活性化酵素の強、所望の強く風味付けされた培養濃縮物を提供するために、３種の風味成分または基質は独立して用いることができ、あるいは２種または３種のグループに合わせることができる。所望であれば、強い嘘質香調を有する嘘質チェダー成分は、シャープなチェダー風味香調を提供するために単独で用いることができる。しかしながら好ましくは、この風味系は　多様な風味付けチーズを提供するために、様々な量で　３種すべての風味成分を用いる。この風味成分または濃縮物は直接に用いることができ　あるいは乾燥（たとえば、噴霧乾燥）して強く風味付けされたチーズ／乳製品粉末を製造することができる。

【００２３】この風味濃縮物またはチーズ粉末は、多様

な風味付けチーズを調製するために用いることができる。本発明はさらに、培養チーズ濃縮物を用いて風味付けチーズを調製する方法を提供し、前記方法は（１）チーズベースを調製すること、（２）約１％から約１０％の培養チーズ濃縮物をチーズベースに混和して風味付けチーズを形成することを含み、この培養チーズ濃縮物は、０％から約８０％の硫黄チェダー風味成分、約１０％から約９０％のクリームバター風味成分、および約１０％から約９０％のチーズ風味成分を含み、硫黄チェダー風味成分は、第１の乳濃縮物を、乳脂肪球膜、ならびに任意選択で脂肪分解酵素および高タンパク質分解活性培養菌で、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して約５．４以下のｐＨを有する第１の混合物を得、第１の混合物に硫黄含有基質を添加して第２の混合物を形成し、第２の混合物をＢｒｅｖｉｂａｃｔｅｒｉｕｍ ｌｉｎｅｎｓ培養菌、あるいはＤｅｂａｒｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍｌｉｎｅｎｓ培養菌または酵母が硫黄含有基質を硫黄含有風味化合物に転換できるように 約３日から約１０日間、華氏約８５度（約２９℃）から華氏約８６度（約３０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の培養菌および酵素を不活性化するのに十分な温度で第３の混合物を処理して硫黄チェダー風味成分を形成することによって調製され クリームバター風味成分は、第２の乳濃縮物を、乳脂培養菌、および任意選択で脂肪分解酵素を用いて、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して第４の混合物を形成し、第４の混合物にクエン酸ナトリウムを添加して第５の混合物を形成し、第５の混合物をジアセチル生成風味培養菌で、約１日から約１０日間、華氏約７０度（約２１℃）から華氏約９０度（約３２℃）で処理して第６の混合物を形成し、第６の混合物の培養菌および酵素を不活性化するのに十分な温度で第６の混合物を処理してクリームバター風味成分を形成することによって調製され、チーズ風味成分は、第２の乳濃縮物を、リパーゼ、プロテアーゼ、およびペプチダーゼを用いて、約０．５日から約１０日間、華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で処理して第７の混合物を形成し、第７の混合物中の酵素を不活性化するのに十分な温度で第７の混合物を処理してチーズ風味成分を形成することによって調製され、培養チーズ濃縮物中の硫黄チェダー風味成分 クリームバター風味成分、およびチーズ風味成分の量 ならびにチーズベースに混和される培養チーズ濃縮物の量は、多様な風味を有する風味付けチーズを得るために調整することができる。

【００２４】本発明はさらに、培養チーズ濃縮物を用いて風味付けチーズを調製する方法を提供し、前記方法は（１）チーズの製造に適した乳基質を調製すること、（２）約１％から約１０％の培養チーズ濃縮物を乳基質に混和すること、（３）乳基質および培養チーズ濃縮物を処理して乳基質を凝固すること、（４）凝固乳基質を切断してカードおよびホエーを形成すること、（５）カードおよびホエーをクッキングすること、（６）ホエーからカードを分離すること、および（７）分離したカードから風味付けチーズを形成することを含み この培養チーズ濃縮物は、０％から約８０％の硫黄チェダー風味成分、および約１０％から約９０％のクリームバター風味成分 および約１０％から約９０％のチーズ風味成分を含み、硫黄チェダー風味成分は、第１の乳濃縮物を 乳脂培養菌、ならびに任意選択で脂肪分解酵素および高タンパク質分解活性培養菌で、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して約５．４以下のｐＨを有する第１の混合物を得、第１の混合物に硫黄含有基質を添加して第２の混合物を形成し、第２の混合物をＢｒｅｖｉｂａｃｔｅｒｉｕｍｌｉｎｅｎｓ培養菌、あるいはＤｅｂａｒｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母を用いて それによってＢｒｅｖｉｂａｃｔｅｒｉｕｍｌｉｎｅｎｓ培養菌または酵母が硫黄含有基質を硫黄含有風味化合物に転換できるように 約３日から約１０日間、華氏約８５度（約２９℃）から華氏約８６度（約３０℃）の温度で処理して第３の混合物を形成し、第３の混合物中の培養菌および酵素を不活性化するのに十分な温度で第３の混合物を処理して硫黄チェダー風味成分を形成することによって調製され クリームバター風味成分は、第２の乳濃縮物を、乳脂培養菌、および任意選択で脂肪分解酵素を用いて、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で処理して第４の混合物を形成し、第４の混合物にクエン酸ナトリウムを添加して第５の混合物を形成し、第５の混合物をジアセチル生成風味培養菌で、約１日から約１０日間、華氏約７０度（約２１℃）から華氏約９０度（約３２℃）で処理して第６の混合物を形成し、第６の混合物の培養菌および酵素を不活性化するのに十分な温度で第６の混合物を処理してクリームバター風味成分を形成することによって調製され チーズ風味成分は、第３の乳濃縮物を、リパーゼ、プロテアーゼ、およびペプチダーゼを用いて、約０．５日から約１０日間、華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で処理して第７の混合物を形成し、第７の混合物中の酵素を不活性化するのに十分な温度で第７の混合物を処理してチーズ風味成分を形成することによって調製され、培養チーズ濃縮物中の硫黄チェダー風味成分 クリームバター風味成分、およびチーズ風味成分の量、ならびに乳基質に混和される培養チーズ濃縮物の量は、多様な風味を有する風味付けチーズを得るために調整することができる。

【００２５】

【発明の実施の形態】本発明の方法において、出発原料は　水性タンパク質および脂肪含有混合物の形態の、乳濃縮物または蒸留である。上述のとおり一般に、主として原宜上、本発明のチーズ風味塩の　３種それぞれの風味成分を調製するために　同一または類似の乳濃縮組成物を用いることが好ましいが、所望であれば、３種それぞれの風味成分を調製するために別々の乳濃縮組成物を用いることができる。この水性の乳由来濃縮物　または液状の濃縮物（すなわち、高度に濃縮された乳系）は、一般に、総固形分含量約３０％から約５０％、タンパク質含量約１０％から約１９％、脂肪含量約１５％から約３０％、ラクトース含量約０．１％から約１０％を有する。好ましくは、この水性乳由来濃縮物は、総固形分含量約３５％から約４７％、タンパク質含量約１２％から約１７％、脂肪含量約１８％から約２５％、ラクトース含量約０．５％から約５％を有する。この基質の混合量は、一般に、約５０％から約７０％、好ましくは約５３％から約６５％である。タンパク質源は、乾燥タンパク質、または濃縮材料であることができ、好ましくは乳製品成分、たとえば、乳タンパク質濃縮物、分画乳タンパク質、濃縮乳脂肪、ホエータンパク質濃縮物、乾燥ホエー、脱脂粉乳、またはそれらの混合物などである。脂肪源は、好ましくは乳脂肪　たとえば無水乳脂肪　バター、クリーム、またはそれらの混合物などである。ダイズタンパク質　トウモロコシタンパク質、コムギタンパク質、および／またはコメタンパク質など、他のタンパク質源を用いることができる。植物油など、他の非乳製本＊品脂肪源を用いることができる。乳濃縮物または蒸留のｐＨは、一般に約６から約７の範囲、好ましくは約６．５から約６．７の範囲である。

【００２６】乾燥タンパク質源は、用いる場合には、水で還元する。水は、基質中の総固分が約５０％から約７０％　好ましくは約５３％から約６５％となるのに十分な量で用いる。この還元タンパク質源を脂肪源と合わせて　基質を提供する。必要であれば、食用酸を添加して　または乳酸生成微生物を用いて、基質のｐＨを適切な範囲（すなわち、約４．６から約５．０、好ましくは約４．８から約５．６）に下げることができる。適切な食用酸は、無毒性無機または有機酸であり、塩酸、酢酸　マレイン酸　酒石酸、クエン酸、リン酸、乳酸、およびそれらの混合物が含まれる。乳濃縮物の調製において、脂肪溶解酵素を減じ、蒸留の均質性を確保するために　所望かつ／または必要であれば、均質化装置を用いることができる。

【００２７】好ましくは、この水性乳由来濃縮物または基質は、膜分離過（単独で、またはさらに好ましくはダイアフィルトレーションとの組合せ）によって調製された液体乳濃縮物　あるいは膜外透過（ＵＦ）または膜外透過／ダイアフィルトレーション（ＵＦ／ＤＦ）された粉乳と乳脂肪の混合物から調製された濃元乳基質である。好ましくは　出発原料は以下の特性を有するＵＦ／ＤＦ乳である。

【００２８】

【表１】

	典型値（%）	好ましい値（%）	より好ましい値（%）
総固形分	30-60	35-47	40
蛋白	50-75	65-85	80
脂肪	15-30	18-25	21
タンパク質	10-19	12-17	14.5
ラクトース	0.1-10	0.5-6	3
塩	1-3	1-2	1-2
灰分	0.5-2.5	1-2	1-2
ｐＨ	6-7	6.5-6.7	6.6

【００２９】好ましい出発原料は、クリームを添加した（０％から約２０％、好ましくは約２％から約１５％）低温殺菌全乳または脱脂乳から調製することができる。次にこの基質を、熱交換器で、当氏約１１０度（約４３℃）から当氏約１４０度（約６０℃）、好ましくは当氏約１２０度（約４９℃）に加熱し　その後、通常の膜外透過／ダイアフィルトレーション装法に供し、約３倍から約８倍（好ましくは　約５倍）の乳濃縮生成物を生成する。たとえば当氏１６８度（約７６℃）で約１６秒間加熱し、当氏約７０度（約２１℃）から当氏約８０度（約２７℃）に冷却した後　この乳濃縮物基質は　本発明の特定の風味成分を調製するために用いることができる。好ましくは　特定の風味成分を生成するために様々な酵素／培養菌／添加前の処理する前に、乳濃縮物基質に約１％から約２％の塩を添加する。この乳濃縮物は比較的に基質のある液体であり、好ましくは約３５％から約４７％の固形分を含有する。

【００３６】図１に示したように、好ましくは約１％から約２％の塩を含有する　液体乳濃縮物を次に３つの部分に分け、特定の風味特性を発理させるのに十分な所定の期間、それぞれを酵素の酵素、培養菌、緩助剤、および他の添加剤で処理（すなわち、発酵）する。特定の酵

素　培養菌、細胞剤、および他の添加剤が与えられ、そこから「硫黄チェダー」成分、「クリームバター」成分　および「チーズ」成分を生成することができる。図１には示していないが、各成分の後れは、発酵の前または後に、任意選択の均質化段階に供することができる。発酵の後、各部分を、培養菌および酵素系を不活性化するのに十分な温度に加熱し、十分な時間その温度に保持する。

【００３１】殺菌不活性化段階の後、所望の強く風味付けされた培養チーズ濃縮物を提供するために、３種の風味成分または基質は独立して用いることができ、あるいは２種または３種のグループに合わせることができる。好ましくは、本発明の培養チーズ濃縮物は、０％から約８０％の硫黄チェダー成分、約１０％から約９０％のクリームバター成分、および約１０％から約９０％のチーズ成分を含有する。より好ましくは、本発明の培養チーズ濃縮物は、約２５％から約７５％の硫黄チェダー成分、約２５％から約７５％のクリームバター成分、および約２５％から約７５％のチーズ成分を含有する。この培養チーズ濃縮物は、成分の物理的配合物であることができ、その配合物を次に所望の風味付けチーズを調製するために用いる。別法として、この培養チーズ濃縮物は　チーズ基質に成分を直接に添加することによって形成することができる。結果として生じた混成物を、その後所望の風味付けチーズを調製するために用いる。

【００３２】実施例５に例示したように、この風味増成単位材料（すなわち、３種の風味成分）を乳基質に添加することができ　それを次にチーズを形成するために用いる。別法として実施例６に例示したように、この風味増成単位材料は、すでに調製されたチーズベースに添加することができる。培養チーズ濃縮物中の３種成分の相対量　ならびに混和される培養チーズ濃縮物の総量は、所望の風味特性に応じて特定の風味の組合せ、または風味普調を得るために多様であることができる。３種の成分およびチーズベースを用いて、以下の表２に例示するように、多岐に渡るチーズタイプを調製することができる。

【００３３】

【表２】

本発明の培養チーズ濃縮物を用いて調製したチーズの例

チーズ		培養チーズ濃縮物（重量部）		
		硫黄チェダー	クリームバター	チーズ
プロセスチーズ		1.7	7	1.3
クリームチーズ		0	8	2
チェダー	マイディアム	1	6	3
	シャープ	3.3	3.3	3.3
	エクストラシャープ	6	1	3
モッツアレラ		0	7.5	2.5
パルメザン		1	3	6
ロマノ		1	1	8

【００３４】一般に、結果として生じるチーズは　約１％から約１０％、好ましくは約２％から約６％の培養チーズ濃縮物を含有する。当然ながら、特に所望の風味プロファイルを得るために、種々の成分の相対量および総量は共に変更および／または最適化できることを、当分野の技術者は理解するであろう。さらに、これらの３種の成分は、他の風味付けチーズを得るために用いることができ、様々なチーズベースに用いることができる（たとえば、プロセスチーズ　プロセスチーズタイプ食品、ナチュラルチーズ、クリームチーズ、カッテージチーズなど）。

【００３５】上述し、図１に示したように、この液体乳濃縮物は３つの部分に分け、特定の風味特性を発現させるのに十分な所定の期間　それぞれを特定の酵素　培養菌　細胞剤、および他の添加剤で処理（すなわち、発酵）する。特定の酵素、培養菌、細胞剤、および他の添加剤が与えられ、そこから「硫黄チェダー」成分、「クリームバター」成分、および「チーズ」成分を生成できる。これらの成分を調製する工程は、ホエー経済価値を必要としない。高風味成分の調製を以下に記載する。

【００３６】硫黄チェダー成分

硫黄チェダー成分の調製は、好ましくは、図１に示した２段階の工程で実施される。第１の段階で、乳脂培養菌を乳基質に添加し、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）で維持し　約5．４以下のｐＨを得る。好ましくは　さらに細胞外酵素、および高タンパク質分解活性培養菌、またはタンパク質分解酵素を　第１段階において乳脂培養

面と共に添加する。次に、それによって培養面または酵母が硫黄含有基質を首尾よく利用する硫黄含有脱臭化合物に転換できるＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌、あるいはＤｅｂａｒｏｍｙｃｅｓまたはＫｌｕｙｅｒｏｍｙｃｅｓ属由来の酵母、および硫黄含有基質を添加し、さらに約３日から１６日間、華氏約６５度（約１８℃）から華氏約８６度（約３０℃）（好ましくは、華氏約７２度（約２２℃））の温度で発酵を継続する。好ましくは、硫黄含有化合物を形成するために、Ｂｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養面を用いる。２つの発酵段階の間に、どのような酵素／培養菌加熱不活性化も存在すべきではない。酵素は、他々の微生物から生成することができ、あるいは植物または動物組織から抽出することができる。この酵素系の他々の酵素は、乾燥粉末、または液体の形状で市販されている。好ましくは、両方の段階は、単一の容器で実施される。好ましくは、反応混合物は、無気状態を防ぎ、良好な混合を提供するために、発酵中通気する。一般に、発酵中の相分離を最小にするように、条件は維持されるべきである。相分離が起こる場合には、発酵後に任意の均質化ステップを用いることができる。２つの発酵ステップまたは段階を完了した後、約１６秒から約３０分間、華氏約１４５度（約６３℃）から華氏約１９０度（約８８℃）好ましくは約１０分間　華氏約１５５度（約６８℃）で加熱することによって、培養面および酵素を不活性化する。好ましくは伝熱を向上させるために　不活性化中、反応混合物を具備撹拌する。

【００３７】上述のとおり、硫黄含有化合物を形成するために、好ましくはＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌を用いる。所望であれば、Ｂｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ類似の活性を提供するように遺伝子的に変性された微生物を、Ｂｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌の代わりに用いることができる。本発明の目的に関して、そのような遺伝子的に変性された微生物は、「Ｂｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌」という用語に包含されるものと考える。

【００３８】本発明の目的に関して、「硫黄含有基質」は、硫黄含有遊離アミノ酸、硫黄含有アミノ酸を含むトリペプチド、および硫黄含有アミノ酸を含むタンパク質水解物である。適した食品タンパク質水解物は、たとえばＱｕｅｓｔ　Ｉｎｔｅｒｎａｔｉｏｎａｌ（イリノイ州　Ｈｏｆｆｍａｎ　Ｅｓｔａｔｅｓ）からＮ－Ｚ－Ａｍｉｎｅ、Ｎ－Ｚ－Ｃａｓｅ、Ｈｙ－Ｃａｓｅ、およびＰｅｐｔｉｃａｓｅの商品名で、ならびに他の製造業者から入手できる。好ましくは、硫黄含有基質には、Ｌ－メチオニン、Ｌ－グルタチオン、およびＬ－システインが含まれる。特に好ましい実施形態において、硫黄含有基質は、Ｌ－メチオニンおよびＬ－グルタチオンの混合物　Ｌ－メチオニンおよびＬ－システインの混合物、またはＬ－メチオニン、Ｌ－グルタチオン、およびＬ－システインの混合物である。硫黄含有基質は、一般に、約０．０１％から約１％の量で添加される。

【００３９】特に好ましい実施形態において、硫黄チェダー成分は、第１段階で乳酸菌物（ｐＨ約６．０から約６．７）を、乳酸培養菌、脂肪分解酵素、および高タンパク質分解活性培養菌で処理し、その後、不活性化せずに、Ｌ－メチオニンおよびＬ－グルタチオンを添加し、またはＬ－メチオニンおよびＬ－システインを添加し、またはＬ－メチオニン、Ｌ－グルタチオン、およびＬ－システインを添加したＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌でさらに処理することによって調製される。この第１段階は、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で実施される。第２段階は、約１日から１０日間、好ましくは約４日から約８日間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で実施される。図１に示したように、２つの段階は逐次的に実施することが好ましいが、単一の発酵段階にまとめることもできる。そのような単一段階の発酵工程は、一般に　約３日から約１０日間、華氏約６５度（約１８℃）から華氏約８６度（約３０℃）で実施される。

【００４０】硫黄チェダー成分を調製するための特に好ましい組成を　以下の表３に記載する。実施例１は、表３に挙げた成分および「熟望香」を用いる硫黄チェダー成分の調製を例示する。

【００４１】

【表３】

成熟チェダー成分を促進するための特に好ましい組成

成分	範囲(%)	典型量(%)	機能
5倍DF/DF乳	バランス	68.78	乳基質
第１段階			
酪脂エステラーゼ	0-1	0.05	脂肪を遊離脂肪酸に加水分解するための精製分解酵素
Lactococcus lactis, および Lactococcus lactis 亜種cremoris	0.001-2	0.01	ラクトースを乳酸に転換し、pHを下げるためのスターターカルチャー
Micrococcus	0.0001-1	0.001	カゼインをペプチドに転換する高タンパク質分解活性を備えた微生物酵素調整物質
第２段階			
Enterobacteriaceae lipase	0.001-2	0.01	硫黄風味化合物を生成するための微生物酵素調整物質
Lメチオニン	0.01-1	0.1	硫黄化合物生成のためのアミノ酸基質
Lグルタチオン	0.01-1	0.1	トリペプチド基質および風味発現のための酸化還元平衡状態を作る処理助剤、遊離アミノ酸に加水分解

【００４２】他の硫黄含有基質は、用いる場合には、一般に約0．０１％から約１％の量で存在する。発酵は、好ましくは、反応混合物が無気となるのを防ぎ、良好な混合を提供するために、通気の状態で実施される。好ましくは、拡散プレートまたは直列空気スパージャを用いて、反応混合物に空気を導入することで通気を行う。適切であれば（すなわち、発酵が起こる場合には）、反応混合物は任意選択でさらなる処理に先立って均質化することができる。発酵の後、培養菌および酵素は、約１６時から約３０分間、華氏約１５０度（約６６℃）から華氏１８５度（約８５℃）で加熱することによって不活性化する。好ましくは、加熱不活性化工程の間、通気は停止する。

【００４３】この硫黄含有基質は、チェダー風味、特にシャープなチェダー風味の発現に重要な硫黄化合物の生成を助けるために添加される。好ましい硫黄含有基質には、Lメチオニン、Lグルタチオン、Lシステイン およびそれらの混合物が含まれる。Lメチオニンは、Ｂｒｅｖｉｂａｃｔｅｒｉｕｍ ｌｉｎｅｎｓ培養菌または酵母（好ましくはＢｒｅｖｉｂａｃｔｅｒｉｕｍ ｌｉｎｅｎｓ）の作用によって硫黄化合物を生じさせるために用いられる。このトリペプチドLグルタチオン（すなわち、グルタミン－システイン－グリシン）、およびアミノ酸Lシステインは、基質として働くことに加えて、所望の硫黄風味化合物（すなわち、メタンチオール、二硫化ジメチル、および三硫化ジメチル）を生じさせることによって風味生成を促進する酸化還元平衡状態を作る処理助剤としても作用する。微生物酵素によるLグルタチオンの遊離アミノ酸への加水分解が、発酵期間中に期待される。さらなる加水分解が、次の加熱処理中（すなわち、不活性化および／またはチーズベースへの混和中）に起こる可能性もある。一般に、最終チーズ製品（すなわち、本発明のチーズ風味系を用いて製造された風味付けチーズ製品）に期待されるLグルタチオンの量は、約１０ｐｐｍ未満である。

【００４４】結果として生じる生成された硫黄チェダー成分は、典型的に、約５０％から約７０％、好ましくは約５３％から約６５％の範囲の固分重量を有する液体またはペーストである。この硫黄チェダー成分は、ホエー濃縮物、またはマルトデキストリンなどの担体材料を添加、または添加せずに、噴霧乾燥して粉末を提供することができる。この硫黄チェダー成分は、一般に、表４に示す以下の風味特性プロファイルを有する。この硫黄チェダー成分は、硫黄含有化合物を含む、効力のある他の寄与または風味化合物を含有すると思われるが、それらは検出されていない。

【００４５】

【表４】

硬質チェダー成分の典型的な揮発プロファイル

	範囲	典型量
メタンチオールｓ	700-15M	3.7M
二硫化ジメチルｓ	1M-80M	9.7M
三硫化ジメチルｓ	1M-60M	8.9M
酢酸	800-1500 ppm	916 ppm
プロピオン酸	<35 #00 ppm	<35 ppm
酪酸	100-800 ppm	585 ppm
ヘキサン酸	10-200 ppm	92 ppm
オクタン酸	10-200 ppm	48 ppm
デカン酸	10-200 ppm	84 ppm
ドデカン酸	10-200 ppm	88 ppm

【００４６】＊嫌資化合物は、ガスクロマトグラフィを用いて求められたピーク面積で報告される。Ｍ＝ミリオン。これらの嫌資化合物の初期ピーク経面積は、本質的にゼロであった。

【００４７】クリームバター成分

クリームバター成分の調製は、好ましくは、図１に示した２段階の工程で実施される。クリームバター成分の調製は、乳酸培養菌を乳濃縮物に添加し、次にその混合物を、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）で発酵することによって実施する。好ましくは、乳酸培養菌と共に、脂肪分解酵素をさらに乳濃縮物に添加する。次にジアセチル生成風味培養菌　およびクエン酸ナトリウムを添加し、約１日から約１０日間、好ましくは約５日から約８日間、華氏約７０度（約２１℃）から華氏約９０度（約３２℃）、好ましくは華氏約８２度（約２８℃）で発酵を続ける。酵素は種々の微生物から生成することができ、あるいは植物または動物組織から精出することができる。この酵素の種々の酵素は、乾燥粉末、または液体の形状で市販されている。好ましくは、反応混合物は　無気状態を防ぎ、良好な混合を提供するために、発酵中撹乱する。相分離は発酵中の著しい問題ではない。発酵ステップが完了した後、培養菌および酵素を、約１６秒から約３０分間、華氏約１４５度（約６３℃）から華氏約１９０度（約８８℃）に、好ましくは約１０分間、華氏約１５５度（約６８℃）に加熱することによって不活性化する。

【００４８】特に好ましい実施形態において、クリームバター成分は　第１段階で乳濃縮物（ｐＨ約６．０から約６．７）を、乳酸培養菌　および酪質エステラーゼで処理し、次に　不活性化をせずに、クエン酸ナトリウムを添加し（一般に約６．０５％から約５％）、さらにクエン酸塩からジアセチルを生成することのできる１種または複数の培養菌で処理することによって調製される。好ましいジアセチル生成培養菌には、Ｌｅｕｃｏｎｏｓｔｏｃ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓが含まれる。この第１段階の発酵は、約１０時間から約２４時間、華氏約７０度（約２１℃）から華氏約８６度（約３０℃）の温度で実施される。第２段階は、約１日から約１０日間、華氏約７０度（約２１℃）から華氏９０度（約３２℃）の温度で実施される。図１に示したように、２つの段階は逐次的に実施することが好ましいが、単一の発酵段階にまとめることもできる。そのような単一段階の発酵工程は、一般に、約１日から約１０日間、華氏約７０度（約２１℃）から華氏９０度（約３２℃）の温度で実施される。

【００４９】上述のとおり、Ｌｅｕｃｏｎｏｓｔｏｃ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ培養菌が、好ましいジアセチル生成風味培養菌である。所望であれば　類似の活性を提供するように遺伝子的に変性された微生物を、Ｌｅｕｃｏｎｏｓｔｏｃおよび／またはＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｓ培養菌の代わりに用いることができる。本発明の目的に関して、そのような遺伝子的に変性された微生物は、「ジアセチル生成風味培養菌」という用語に包含されるものと考える。

【００５０】クリームバター成分を調製するための特に好ましい組成を　以下の表５に記載する。実施例２は、表らに挙げた成分および「撹型置」を用いるクリームバター成分の調製を例示する。

【００５１】

【表５】

33　　32

クリームバター成分を調製するための特に好ましい組成

成分	範囲（%）	典型量（%）	機能
5倍 UF/DF 乳	バランス	99.83	乳基質
第１段階			
細胃エステラーゼ	0-1	0.02	脂肪を遊離脂肪酸に加水分解する脂肪分解酵素
Lactococcus lactis、およびLactococcus lactis 亜種 cremoris	0.001-2	0.01	ラクトースを乳酸に転換し、ｐＨを下げるためのスターターカルチャー
第２段階			
アセト酸ナトリウム	0.01-10	0.8	ジアセチル生成、および風味発生の基質
Leuconostoc	0-1	0.0001	クエン酸塩からジアセチルを生成するための風味補助剤培養菌
Lactococcus lactis 亜種 lactis 変形種 diacetylactis	0-1	0.0001	クエン酸塩からジアセチルを生成するための風味補助剤培養菌

【００５２】発酵の後、増養槽および酵素は、約１６秒から約３０分間、華氏約１４５度（約６３℃）から華氏約１９０度（約８８℃）で　好ましくは約１０分間、華氏約１５５度（約６８℃）で加熱することによって不活性化する。好ましくは、加熱不活性化工程中、または工程後、通気は用いない。

【００５３】結果として生じる生成されたクリームバター成分は、典型的に、約５０％から約７０％、好ましくは約５３％から約６５％の範囲の優外含量を有する液体＊＊またはペーストである。このクリームバター成分は、ホエー濃縮物、またはマルトデキストリンなどの担体材料を添加、または添加せずに、噴霧乾燥して粉末を提供することができる。このクリームバター成分は、一般に、表６に示す風味特性プロフィールを有する。このクリームバター成分は、検出されていない　効力を有する他の芳香または風味化合物を含有すると思われる。

【００５４】

【表６】

クリームバター成分の典型的な風味プロフィール

	範囲（ｐｐｍ）	典型量（ｐｐｍ）
エタノール	1-160	41
アセトン	1-6	2
ジアセチル	20-400	176
酪酸	400-1000	660
プロピオン酸	<25-100	<25
酪酸	200-600	275
ヘキサン酸	20-150	88
オクタン酸	10-100	30
デカン酸	50-150	86
ドデカン酸	80-160	105

【００５５】チーズ成分

チーズ成分は　一般に、参照により本明細書の一部とする１９９８年８月２７日出願の和時係属米国特許出願第０９／１４１０８２号に記載された出発原料および手順を用いて調製することができる。このチーズ成分を調製するために用いる酵素系には、リパーゼ、プロテアーゼ　およびペプチダーゼが含まれる。約０．５日から約１０日間、好ましくは約１日から約３日間、華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で原料をこの酵素系で処理して、所望のチーズ風味レベルに到達させる。酵素は種々の微生物から生成することができ、あるいは植物または動物組織から抽出することができる。この酵素系の種々の酵素は　乾燥粉末、または液体の形状で市販されている。

【００５６】リパーゼ（エステラーゼと呼ばれることもある）は、当分野でよく知られている酵素である。リパーゼは、典型的に動物（ヤギシ、子ウギ、または子ヒツジ）の咽喉組織、成熟動物の膵臓　または微生物源から得られる。咽喉組織から得られた種々の市販の調製を、種々の商品名で、ＳＫＷ　Ｂｉｏｉｎｄｕｓｔｒｉｅｓ　Ｍａｒｓｃｈａｌｌ　Ｌａｂｏｒａｔｏｒｙ、または他のそのような会社から入手できる。この酵素は、食用の咽喉を塩および脂肪酸と共に粉砕し、その混合物を乾燥し、再び粉砕することによって生成することが

できる。リパーゼの微生物源は、たとえば、カビのCandida cylindraceaType VIII Aspergillus oryzae、A. niger、Penicillium roqueforti、P. glaucum、およびRhizopus oryzaeである。

【００５７】チーズ成分の調製において、粉末リパーゼ（好ましくは菌リパーゼ）は、一般に、約０．０５％から約０．４％の量で用いられる。適した菌リパーゼは、Lipomod １８７の商品名で、Biocatalystsから市販されている。

【００５８】プロテアーゼは、菌、植物、または動物源から得ることのできる、当分野でよく知られている酵素である。適したプロテアーゼの例には Enzyme Development Corp. から入手可能なEnzeco NeutralBacterial Protease ２X、およびBiocatalystから入手可能なPromod ２１５が含まれる。該ポプロテアーゼは一般に、約０．０１％から約１％の量で、好ましくは０．１％から約０．４％の量で用いられる。

【００５９】ペプチダーゼ活性、好ましくはアミノペプチダーゼ活性を有する酵素がこの酵素系において用いられ そのような酵素は、タンパク質加水分解から生じた吉味ペプチドに作用する。ペプチダーゼ酵素はプロテアーゼ酵素と共同して、チーズ風味に寄与する高濃度の遊離アミノ酸およびペプチドを生じさせる。このペプチダーゼは、精製酵素材料であることができ、あるいはLactobacillus helveticusなど、ペプチダーゼ活性を生ずる微生物の細胞であることができる。この培養細胞は、噴霧乾燥、凍結乾燥、凍結、または新たに培養した細胞であることができ 基質中で非成長、または増殖可能のどちらかであることができる。噴霧乾燥Lactobacillus helveticus細胞は、約０．０１％から約３％、好ましくは約０．０５％から約０．３０％の量で用いられる。好ましい酵素は該菌である。しかしながら、これらの酵素の適切な液体形状は、本発明での使用に許容されるであろう。

【００６０】約９．５日から約１０日間、好ましくは約１日から約３日間、基質をこの酵素系で処理して 所望のチーズ風味レベルに到達させる。この処理は、華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で実施する。所望の熟味レベルは官能的に判断することができ、かつｐＨ、滴定酸度、ならびに遊離脂肪酸およびアミノ酸の濃度など 分析的測定によって確定することができる。目標の熟味に到達したら、華氏約１６０度（約７１℃）から華氏約２１０度（約９９℃）の温度に混合物を加熱し、完全な酵素の失活を確実なものにするのに十分な時間（たとえば、約５分から約６０分）その高い温度に基質を保持することによって酵素を不活性化する。

【００６１】所望の風味プロファイルを提供するために、酵素は逐次的に、またはすべてを同時に添加することができる。逐次的な酵素の追加においては、１種または複数の酵素を添加し、約４時間から約５日間の処理時間を実施する。その後、残りの酵素を添加し、約０．５日から約５日 所定のさらなる期間、処理を継続する。酵素の逐次的追加の間に不活性化ステップは存在しない。

【００６２】本発明の他の実施形態において、第１の酵素処理は、華氏約１２０度（約４９℃）から華氏約１４０度（約６０℃）の比較的高温で行われる。少なくとも１種の酵素を添加し、第１処理の約２時間から約８時間の間、この温度でインキュベートする。次に、華氏約６０度（約１６℃）から華氏約１４０度（約６０℃）の温度で実施される約８時間から約１０日間の第２の処理期間に、残りの酵素を添加する。

【００６３】この工程は、逐次的な段階のために別の容器に移すことなく単一の容器で実施することができ、好ましくはそのように行われる。容器は 酵素と基質材料との間の良好な接触を確保し、撹拌器中の凝固分を維持するために、優先的に混合装置を備えている。スクレープドサーフェイス混合タンクが好ましい。随時用の水性材料からの分離を防ぎ、撹拌装中の固形分の維持を助けるために、再循環、および均質化装置を用いることができる。所望の温分含量を維持するために発酵中に水を加えることができ ｐＨを調整するために酸性または塩基性材料を加えることができる。

【００６４】特に好ましい実施形態において、チーズ成分は図１に示したように、リン酸一ナトリウムを添加した乳濃縮物（ｐＨ約６．０から約６．７）を、中性細菌プロテアーゼ、アミノペプチダーゼ活性を有する酵素、菌プロテアーゼ および菌リパーゼで、約２日間 華氏約１００度（約３８℃）から華氏約１１０度（約４３℃）の温度で処理することによって調製される。

【００６５】チーズ成分を調製するための特に好ましい組成を、以下の表７に記載する。実施例３は、表７に示すた成分および「典型量」を用いるチーズ成分の調製を例示する。

【００６６】

【表７】

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チーズ成分を調製するための特に好ましい組成

成分	範囲（%）	典型値（%）	機能
5倍 UF/MF 乳	バランス	98.2	乳基質
乳酸一水和物	0.1-3	1.0	製剤後中の固形分の維持を助ける乳化剤
中性細菌プロテアーゼ（Enzeco Neutral Bacterial Protease 5X, Enzyme Development Corp）	0.01-1	0.15	風味生成のために、乳タンパク質をポリペプチド、ペプチド、アミノ酸に加水分解する中性細菌プロテアーゼ
Lactobacillus helveticus(EnzoBeat, Mediapharm)	0.01-3	0.14	熟成促進、アミノペプチダーゼ活性
脂肪分解酵素（Pronoad 21b, Biocatalysts）	0.01-1	0.20	風味生成のために、乳タンパク質をポリペプチド、ペプチド、アミノ酸に加水分解するタンパク質分解酵素
脂肪分解酵素（Laporiod 187, Biocatalysts）	0.01-1	0.15	脂肪を遊離脂肪酸に加水分解し、脂肪分解風味増強剤を発現するリパーゼ酵素
ソルビン酸	0.01-0.5	0.1	カビ抑制剤

【００６７】発酵は、好ましくは、反応混合物が無気となるのを防ぎ　良好な混合を提供するために、撹拌ポンプを用いて再循環した状態で実施する。発酵後　熱（一般に摂氏約１８５度（約８５℃）約３０分間）を加えることによって酵素を不活性化する。好ましくは　加熱不活性化工程の間　再循環を続けるが　撹拌ポンプは用いない。上述の表の成分を用いて調製した好ましいチーズ成分は、一般に　同時係属米国特許出願第０９／１４１０８２号に記載された特定の出発原料および手順を用いて調製された類似の成分に比べて、改善された風味特性（すなわち、より強いチーズの「投い味」）を有する。

【００６８】結果として生じる生成されたチーズ成分　＊は　典型的に　約５０％から約７０％　好ましくは約５３％から約６５％の範囲の湿分含量を有する流体またはペーストである。このチーズ成分は、ホエー濃縮物、またはマルトデキストリンなどの担体材料を添加　または添加せずに、噴霧乾燥して粉末を提供することができる。このチーズ成分は、一般に、表８に示す風味特性／プロファイルを有する。このチーズ成分は、検出されていない、効力を有する他の香香または風味化合物を含有すると思われる。

【００６９】

【表８】

チーズ成分の典型的な風味プロファイル

	範囲	典型値
ビタミンＡ活性	9-34 IU (100%)	9-11 IU (100%)
プロテアーゼ活性	4-55 FI 強度　単位/分/g	0.65 FI 強度　単位/分/g
酢酸	10-100 ppm	38 ppm
プロピオン酸	<25 ppm-190	<100 ppm
酪酸	2000-7000 ppm	5823 ppm
ヘキサン酸	1000-6000 ppm	3854 ppm
オクタン酸	1000-4000 ppm	3982 ppm
デカン酸	2000-10000 ppm	6250 ppm
ドデカン酸	2000-10000 ppm	7145 ppm

【００７０】以下の実施例は、本発明の様々な特徴をさらに例示するが　添付の請求の範囲に述べた本発明の範囲をいかなる点においても限定するものではない。明段の指示がない限り、すべてのパーセントおよび比率は重量による。本明細書で言及した参考文献はすべて　参照により本明細書の一部とする。

【００７１】実施例１

本実施例は、硫黄チェダー成分の調製を例示する。新鮮な全乳を、乾燥物質に基づいて約５４％の脂肪含量を有する標準化乳を得るのに十分な量で　新鮮なクリームと

合わせた。この練混ぜ具を　高温熱交換器（ＨＴＳＴ）で１８秒間、華氏１６４度（約７３℃）で低温殺菌し、その後、華氏１３０度（約５４℃）に冷却した。次に冷却した乳を、ダイアフィルトレーション（ＤＦ）を備えた熱交換限外濾過（ＵＦ）システムで５倍に濃縮し、ラクトース含量を約１％に減じた。２％の塩を添加したＵＦ／ＤＦ乳（約１９１５ｋｇ（４２２２ポンド））を、撹拌ジャケット付き容器で１０分間　華氏１５５度（約６８℃）で加熱処理し、その後、華氏７８度（約２６℃）に冷却した。この乳濃縮物は、固形分４１．８％、脂肪２２．６％、およびタンパク質１５．４％を含有し、ｐＨ６．４を有した。

【００７２】乳酸スターターカルチャー（０．０１％、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ　Ｃｈｒ．Ｈａｎｓｅｎｓ　ｉｎｃ．のＲ６０３）、Ｍｉｃｒｏｃｏｃｃｕｓ（０．００１％）、および前胃エステラーゼ（０．０２％）を乳濃縮物に添加し、第１段階において１７時間、華氏７５度（約２４℃）で発酵し、ｐＨは５．１６に達した。Ｌ－メチオニン（０．１％）、Ｌ－グルタチオン（０．１％）およびＢｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓの活性化培養菌（１％）を第１段階発酵生成物に添加し、発酵工程の第２段階を開始した。Ｂｒｅｖｉｂａｃｔｅｒｉｕｍ　ｌｉｎｅｎｓ培養菌は使用の前に、好気条件下、４８時間　華氏７５度（約２４℃）で、トリプシンダイズ培養液（ＴＳＢ）中で活性化した。第２段階の発酵を華氏７２度（約２２℃）の温度でさらに７日間、通気の状態で継続した。第２段階終了時のｐＨは　６．７５であった。嫌資化合物（すなわち、メタンチオール、二硫化ジメチル、および三硫化ジメチル）の量は、発酵工程中、劇的に増大した（表４の結果を参照）。結果として生じた硫黄チェダー成分を、培養菌および酵素を不活性化し　製品の貯蔵寿命を延ばすために、１０分間　華氏１５５度（約６８℃）に加熱した。この不活性化ステップにおいて、比較的小さな嫌資化合物の損失が認められた。結果として生じた硫黄チェダー成分の風味プロファイルは、上述の表４において「典型量」の項に記載されている。この嫌資チェダー成分は約４１％の総固形分を有し、所望であれば、噴霧乾燥し、嫌資チェダー風味粉末を形成することができた。

【００７３】実施例２

本実施例は、クリームバター成分の調製を例示する。実施例１で調製したものと類似の乳濃縮物を、出発基質として用いた。

【００７４】乳酸スターターカルチャー（０．０１％、Ｌａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ、およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｃｒｅｍｏｒｉｓ　Ｃｈｒ．Ｈａｎｓｅｎｓ　ｉｎｃ．のＲ６０３）、および前胃エステラーゼ（０．０２％）を乳濃縮物に添加し　第１段階において１７時間、華氏７５度（約２４℃）で発酵し、ｐＨは５．１６に達した。華氏８２度（約２８℃）に加熱した後　クエン酸ナトリウム（０．２％）、なびにＬｅｕｃｏｎｏｓｔｏｃ（０．１％）およびＬａｃｔｏｃｏｃｃｕｓ　ｌａｃｔｉｓ亜種ｌａｃｔｉｓ次亜種ｄｉａｃｅｔｙｌａｃｔｉｃ培養菌は使用の前に、一般　華氏７５度（約２４℃）で、ＭＲＳ培養液中で活性化した。第２段階の発酵を、華氏８２度（約２８℃）の温度でさらに６日間、通気の状態で継続した。第２段階終了時のｐＨは、５．２６であった。ジアセチルの量は、初期値の約１ｐｐｍから、第２段階終了時には約１７６ｐｐｍに上昇した。結果として生じたクリームバター成分を、培養菌および酵素を不活性化し、製品の貯蔵寿命を延ばすために、１０分間　華氏１５５度（約６８℃）に加熱した。この不活性化ステップにおいて、比較的小さなジアセチルの損失が認められた。結果として生じたクリームバター成分の風味プロファイルは、上述の表６において「典型量」の項に記載されている。このクリームバター成分は約４２％の総固形分を有し、所望であれば　噴霧乾燥し　クリームバター風味粉末を形成することができた。

【００７５】実施例３

本実施例は、チーズ成分の調製を例示する。乳濃縮物を、乳タンパク質濃縮（ＭＰＣ）粉末、水、無水乳脂肪、および塩を用いて調製した。

【００７６】ＭＰＣ粉末および塩を、ＶａｃｕｕｍＣａｍ　Ｉｎｊｅｃｔｉｏｎミキサで温水を用いて水和し、タンパク質スラリーを形成した。脱気ポンプを用いて連続再循環した脱気ジャケット付き容器に、タンパク質スラリーを移した。次に溶融した無水乳脂肪を添加し、乳濃縮物を形成した。結果として生じた乳濃縮物は　固形分４３．５％、脂肪１８．６％、タンパク質１３．７％　ラクトース２．８％　および塩１．８５％を含有した。

【００７７】乳濃縮物は、発酵工程中　剪断ポンプを用いて連続再循環した状態で同一の撹拌ジャケット付き容器に維持した。リン酸一ナトリウム（０．５％）を添加し　スラリーを１５分間　華氏１６２度（約７２℃）で加熱した。華氏１０４度（約４０℃）に冷却後　中性細菌プロテアーゼ（約０．１８％、Ｅｎｚｅｃｏ　Ｎｅｕｔｒａｌ　Ｂａｃｔｅｒｉａｌ　Ｐｒｏｔｅａｓｅ　２　Ｘ．Ｅｎｚｙｍｅ　Ｄｅｖｅｌｏｐｍｅｎｔ　Ｃｏｒｐ．）、Ｌａｃｔｏｂａｃｉｌｌｕｓ　ｈｅｌｖｅｔｉｃｕｓ（約０．１４％、ＥｎｚｏＢａｃｔ、Ｍｅｄｉｐｈａｒｍ）、酸プロテアーゼ（約０．２８％、Ｐｒｏｍｏｄ　２１５　Ｂｉｏｃａｔａｌｙｓｔｓ）、および固

リパーゼ（約０．２８％ Ｌｉｐｏｍｏｄ １８７，Ｂｉｏｃａｔａｌｙｓｔｓ）を含有する酵素スラリーを添加した。バーセントは発酵混合物の総重量に基づく。乳摂液を破砕するために回転ポンプを用いて連続撹拌および再循環をした状態で、４８時間、華氏１０４度（約４０℃）で発酵を継続した。発酵を完了した後、３０分間、華氏約１８５度（約８５℃）に加熱することによって酵素を不活性化した。不活性化の間、連続を続けたが、回転ポンプは用いなかった。結果として生じたチーズ成分の凝固プロファイルは、上述の表８において「典型重」の項に記載されている。次にソルビン酸（約０．１％）を添加した。このチーズ成分は約４３％の凝固形分を有し、所望であれば、噴霧乾燥し、チーズ風味粉末を形成することができた。

【００７８】実施例４

乳約１５．４ｋｇ（３４ポンド）（バター脂肪３．５％）、および２倍強度のアナト－着色剤０．７５ｍｌを、華氏８８度（約３１℃）の温度で、小さなチーズバットに加えた。凝結ペレット状スターターカルチャー（２．４５ｇ Ｃｈｒ．Ｈａｎｓｅｎｓ Ｉｎｃ．）を添加し、この混合物を３０分間熟成させた。風味構成単位材料（すなわち、実施例１、２、および３で生成した硫黄チェダー、クリームバター、チーズ成分、それぞれ１：１：１の比率、総重３０ｇ）を、熟成乳に混合した。次にレンネット（１．７ｍｌ，Ｃｈｙｍａｘ Ｅｘｔｒａ，Ｃｈｒ．Ｈａｎｓｅｎｓ Ｉｎｃ．）を添加し、生じた混合物を撹拌せずに３０分間凝固させた。次に凝固カードを約０．９５ｃｍ（３／８インチ）の立方体に切断し、１５分間静置した。静止期間の後、３０分間かけて温度を華氏１０２度（約３９℃）に上昇させながら、カードを手で静かに撹拌した。カードを１時間、華氏１０２度（約３９℃）でクッキングし、この時間でホエーをカードから排液した。カードを固形の塊に融合させ、９０分の間、１５分毎に反転した。結果として生じた小さなスラブを約１．２７×１．２７×０．８ｃｍ（１／２×１／２×２インチ）の小片にミリングした。各添加の間に５分の間隔を置き、塩を３回添加した（１２．９ｇ／添加）。生じた加塩カードを小さなチーズフープに入れ、一晩加圧した。加圧後、チーズを真空チャンバに入れ、さらに１時間加圧した。完全に加圧したチーズは、評価までプラスチックに真空封入した。対照チーズを同一の方法で、ただし風味構成単位材料を含まずに調製した。風味構成単位材料を用いて調製したチーズは、良好な風味および官能的特性を提供した。

【００７９】実施例５

乳約１５．４ｋｇ（３４ポンド）（バター脂肪３．５％）、および２倍強度のアナト－着色剤０．７５ｍｌを、華氏８８度（約３１℃）の温度で小さなチーズバットに加えた。凝結ペレット状スターターカルチャー（２．４５ｇ Ｃｈｒ．Ｈａｎｓｅｎｓ Ｉｎｃ．）を

添加し、この混合物を３０分間熟成させた。次にレンネット（１．７ｍｌ，Ｃｈｙｍａｘ Ｅｘｔｒａ，Ｃｈｒ．Ｈａｎｓｅｎｓ Ｉｎｃ．）を添加し、生じた混合物を撹拌せずに３０分間凝固させた。次に凝固カードを約０．９５ｃｍ（３／８インチ）の立方体に切断し、１５分間静置した。静止期間の後、３０分間かけて温度を華氏１０２度（約３９℃）に上昇させながら、カードを手で静かに撹拌した。カードを１時間、華氏１０２度（約３９℃）でクッキングし、この時間でホエーをカードから排液した。カードを固形の塊に融合させ、９０分の間、１５分毎に反転した。結果として生じた小さなスラブを約１．２７×１．２７×０．８ｃｍ（１／２×１／２×２インチ）の小片にミリングした。連続乾燥した風味構成単位材料（すなわち、実施例１、２、および３で生成した硫黄チェダー、クリームバター、チーズ成分、それぞれ１：１：１の比率、総重３０ｇ）を塩３８．９ｇと混合し、その後、３つの部分に分けた。各添加の間に５分の間隔を置き、構成単位材料と塩の混合物を３回添加した（２２．９ｇ／添加）。生じた加塩カードを小さなチーズフープに入れ、一晩加圧した。加圧後、チーズを真空チャンバに入れ、さらに１時間加圧した。完全に加圧したチーズは、評価までプラスチックに真空封入した。対照チーズを同一の方法で、ただし風味構成単位材料を含まずに調製した。風味構成単位材料を用いて調製したチーズは、良好な風味および官能的特性を提供した。

【００８０】実施例６

実施例１で調製した硫黄チェダー風味成分、実施例２で調製したクリームバター風味成分、および実施例３で調製したチーズ風味成分を用いて、シャープなチェダー風味香調を有する低温殺菌プロセスチーズスプレッドの塊を調製した。硫黄チェダー風味成分約１％、クリームバター風味成分約４％、およびチーズ成分約１％を、若いチーズおよびマイルドチーズの混合物に添加した。次に他の成分を以下の通りに添加した。

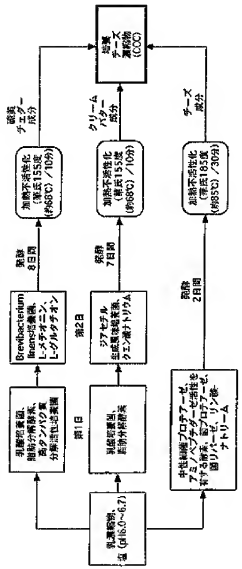
【００８１】ホエー粉末　＜１％
乳タンパク質濃縮物　＜１％
ソルビン酸　＜０．５％
チーズ着色剤　＜０．５％
リン酸一ナトリウム、およびリン酸二ナトリウム　～３％

【００８２】結果として生じたチーズ混合物を、華氏１７５度（約７９℃）で、Ｄａｍｒｏｗレイダウン直接蒸気導入クッカー（Ｄａｍｒｏｗ Ｃｏ．Ｉｎｃ．ウィスコンシン州フォンデュラック）で処理した。加熱溶融したチーズを約０．９ｋｇ（２ポンド）の塊に成形し、強制空冷器で華氏４０度（約４℃）に冷却した。得られた低温殺菌プロセスチーズスプレッドの塊は、熱硬チェダーチーズを用いて作られた調製チーズ製品と類似の風味、官能、および溶融性を有した。

【図面の簡単な説明】

【図１】本発明の熟成チェダー風味成分、クリームバター風味成分、およびチーズ風味成分を含有する培養チーズ濃縮物の調製を例示する図である。

【図１】



フロントページの続き

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Ｆターム(参考)　4B001 AC25 AC26 AC30 AC31 BC14 EC01
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【外国語明細書】

1. Title of the Invention

NATURAL BLOGENERATED CHEESE FLAVORING SYSTEM

2. Claims

1. A flavoring system for food products, said system comprising a sulfury-cheddar flavor component, a creamy-buttery flavor component, and a cheesy flavor component,

wherein the sulfury-cheddar flavor component is prepared by treating a first milk concentrate with a lactic acid culture at a temperature of about 70 to about 86°F for about 10 to about 24 hours to obtain first mixture having a pH of about 5.4 or less, adding a sulfur-containing substrate to the first mixture to form a second mixture, treating the second mixture with a *Brevibacterium linens* culture or a yeast from the genera *Debaromyces* or *Kluyeromyces*, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a third mixture, and treating the third mixture at a temperature sufficient to inactivate the cultures and enzymes in the third mixture to form the sulfury-cheddar flavor component;

wherein the creamy-buttery flavor component is prepared by treating a second milk concentrate with a lactic acid culture at a temperature of about 70 to about 86°F for about 10 to about 24 hours to form a fourth mixture, adding sodium citrate to the fourth mixture to form a fifth mixture, treating the fifth mixture with a diacetyl-producing flavor culture at about 70 to about 90°F for about 1 to about 10 days to form a sixth mixture, and treating the sixth mixture at a temperature sufficient to inactivate the cultures and enzymes in the sixth mixture to form the creamy-buttery flavor component;

wherein the cheesy flavor component is prepared by treating a third milk concentrate with a lipase, a protease, and a peptidase at a temperature of about 60 to about 140°F for about 0.5 to about 10 days to form a seventh

mixture and treating the seventh mixture at a temperature sufficient to inactivate enzymes in the seventh mixture to form the cheesy flavor component; and

wherein the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component of the cheese flavoring system can be incorporated in varying amounts into food products to produce a wide variety of flavors.

2. The flavoring system of claim 1, wherein the food products are cheese products and the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component of the flavoring system are incorporated into a cheese or dairy base to produce the cheese products.

3. The flavoring system of claim 2, wherein the first milk concentrate is also treated with a lipolytic enzyme and a high proteolytic activity culture, wherein the second milk concentrate is also treated with a lipolytic enzyme, and wherein the *Brevibacterium linens* culture is used to prepare the sulfury-cheddar flavor component.

4. The favoring system of claim 3, wherein the sulfur-containing substrate is L-methionine, L-glutathione, L-cysteine, or mixtures thereof.

5. The flavoring system of claim 4, wherein the first milk concentrate, the second milk concentrate, and the third milk concentrate are prepared by an ultrafiltration/diafiltration process, and wherein the first milk concentrate, the second milk concentrate, and the third milk concentrate independently have total solid levels of about 30 to about 50 percent, moisture levels of about 50 to about 70 percent, fat levels of about 15 to about 27 percent, protein levels of about 10 to about 20 percent, lactose levels of about 0.5 to about 2 percent, and salt levels of about 1 to about 3 percent.

6. The flavoring system of claim 4, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*; the lipolytic enzyme used to prepare the sulfury-cheddar flavor component is pregastric esterase; and the high proteolytic activity culture used to prepare the sulfury-cheddar flavor component is a *Micrococcus*.

7. The flavoring system of claim 5, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is Lactococcus lactis, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof; the lipolytic enzyme used to prepare the sulfury-cheddar flavor component is pregastric esterase; and the high proteolytic activity culture used to prepare the sulfury-cheddar flavor component is a *Micrococcus*.

8. The flavoring system of claim 4, wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof; the lipolytic enzyme used to prepare the creamy-buttery flavor component is pregastric esterase; and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc*, *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*, or mixtures thereof.

9. The flavoring system of claim 5, wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof; the lipolytic enzyme used to prepare the creamy-buttery flavor component is pregastric esterase; and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc*, *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*, or mixtures thereof.

10. The flavoring system of claim 4, wherein the lipase used to prepare the cheesy flavor component is a fungal lipase; the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof; and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

11. The flavoring system of claim 5, wherein the lipase used to prepare the cheesy flavor component is a fungal lipase; the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof; and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

12. The flavoring system of claim 4,

wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*, the lipolytic enzyme used to prepare the sulfury-cheddar flavor component is pregastric esterase, and the high proteolytic activity culture used to prepare the sulfury-cheddar flavor component is a *Micrococcus*;

wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof, the lipolytic enzyme used to prepare the creamy-buttery flavor component is pregastric esterase, and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc*, *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*, or mixtures thereof; and

wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

13. The flavoring system of claim 5,

wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*, the lipolytic enzyme used to prepare the sulfury-cheddar flavor component is pregastric esterase, and the high proteolytic activity culture used to prepare the sulfury-cheddar flavor component is a *Micrococcus*;

wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof, the lipolytic enzyme used to prepare the creamy-buttery flavor component is pregastric esterase, and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc*, *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*, or mixtures thereof; and

wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

14. The flavoring system of claim 4, wherein the sulfury-cheddar flavor component is dried to form a powdered sulfury-cheddar flavor component, the creamy-buttery flavor component is dried to form the powdered creamy-buttery flavor component, and the cheesy flavor component is dried to form a powdered cheesy flavor component.

15. The flavoring system of claim 5, wherein the sulfury-cheddar flavor component is dried to form a powdered sulfury-cheddar flavor component, the creamy-buttery flavor component is dried to form the powdered creamy-buttery flavor component, and the cheesy flavor component is dried to form a powdered cheesy flavor component.

16. The flavoring system of claim 12, wherein the sulfury-cheddar flavor component is dried to form a powdered sulfury-cheddar flavor component, the creamy-buttery flavor component is dried to form the powdered creamy-buttery flavor component, and the cheesy flavor component is dried to form a powdered cheesy flavor component.

17. The flavoring system of claim 13, wherein the sulfury-cheddar flavor component is dried to form a powdered sulfury-cheddar flavor component, the creamy-buttery flavor component is dried to form the powdered creamy-buttery flavor component, and the cheesy flavor component is dried to form a powdered cheesy flavor component.

18. A method of preparing a flavored cheese using a cultured cheese concentrate, said method comprising:

(1) preparing a cheese or dairy base;

(2) incorporating about 1 to about 10 percent of the cultured cheese concentrate into the cheese or dairy base to form the flavored cheese;

wherein the cultured cheese concentrate comprises 0 to about 80 percent of a sulfury-cheddar flavor component, about 10 to about 90 percent of a creamy-buttery flavor component, and about 10 to about 90 percent of a cheesy flavor component;

wherein the sulfury-cheddar flavor component is prepared by treating a first milk concentrate with a lactic acid culture at a temperature of about 70 to about 86°F for about 10 to about 24 hours to obtain first mixture having a pH of about 5.4 or less, adding a sulfur-containing substrate to the first mixture to form a second mixture, treating the second mixture with a *Brevibacterium linens* culture or a yeast from the genera *Debaromyces* or *Kluyveromyces*, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a third mixture, and treating the third mixture at a temperature sufficient to inactivate cultures

and enzymes in the third mixture to form the sulfury-cheddar flavor component;

wherein the creamy-buttery flavor component is prepared by treating a second milk concentrate with a lactic acid culture at a temperature of about 70 to about 86°F for about 10 to about 24 hours to form a fourth mixture, adding sodium citrate to the fourth mixture to form a fifth mixture, treating the fifth mixture with a diacetyl-producing flavor culture at about 70 to about 90°F for about 1 to about 10 days to form a sixth mixture, and treating the sixth mixture at a temperature sufficient to inactivate the cultures and enzymes in the sixth mixture to form the creamy-buttery flavor component;

wherein the cheesy flavor component is prepared by treating a third milk concentrate with a lipase, a protease, and a peptidase at a temperature of about 60 to about 140°F for about 0.5 to about 10 days to form a fifth mixture and treating the fifth mixture at a temperature sufficient to inactivate enzymes in the fifth mixture to form the cheesy flavor component; and

wherein the amounts of the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component in the cultured cheese concentrate and the amount of cultured cheese concentrate incorporated into the cheese or dairy base can be adjusted to obtain flavored cheeses having a wide variety of flavors.

19. The method as in claim 18, wherein the first milk concentrate is also treated with a lipolytic enzyme and a high proteolytic activity culture, wherein the second milk concentrate is also treated with a lipolytic enzyme, and wherein the *Brevibacterium linens* culture is used to prepare the sulfury-cheddar flavor component.

20. The method as in claim 19, wherein the sulfur-containing substrate is L-methionine, L-glutathione, L-cysteine, or mixtures thereof.

21. The method as in claim 19, wherein the cultured cheese concentrate comprises about 25 to about 75 percent of the sulfury-cheddar flavor component, about 25 to about 75 percent of the creamy-buttery flavor component, and about 25 to about 75 percent of the cheesy flavor component.

22. The method as in claim 19, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*, the lipolytic enzyme used to prepare the sulfury-cheddar flavor component is pregastric esterase, and the high proteolytic activity culture used to prepare the sulfury-cheddar flavor component is a *Micrococcus*; wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof, the lipolytic enzyme used to prepare the creamy-buttery flavor component is pregastric esterase, and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc*, *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*, or mixtures thereof; and wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

23. The method of claim 19, wherein the cultured cheese concentrate is a dried powder.

24. The method of claim 22, wherein the cultured cheese concentrate is a dried powder.

25. A method of preparing a flavored cheese using a cultured cheese concentrate, said method comprising:

(1) preparing a milk substrate suitable for producing a cheese;

(2) incorporating about 1 to about 10 percent of the cultured cheese concentrate into the milk substrate;

(3) treating the milk substrate and cultured cheese concentrate to set the milk substrate;

(4) cutting the set milk substrate to form curds and whey;

(5) cooking the curds and whey;

(6) separating the curds from the whey; and

(7) forming the flavored cheese from the separated curds;

wherein the cultured cheese concentrate comprises 0 to about 80 percent of a sulfury-cheddar flavor component, about 10 to about 90 percent of a creamy-buttery flavor component, and about 10 to about 90 percent of a cheesy flavor component;

wherein the sulfury-cheddar flavor component is prepared by treating a first milk concentrate with a lactic acid culture at a temperature of about 70 to about 86°F for about 10 to about 24 hours to obtain first mixture having a pH of about 5.4 or less, adding a sulfur-containing substrae to the first mixture to form a second mixture, treating the second mixture with a *Brevibacterium linens* culture or a yeast from the genera *Debaromyces* or *Kluyeromyces*, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 55 to about 86°F for about 3 to about 10 days to form a third mixture, and treating the third mixture at a temperature sufficient to inactivate cultures and enzymes in the third mixture to form the sulfury-cheddar flavor component;

wherein the creamy-buttery flavor component is prepared by treating a second milk concentrate with a lactic acid culture at a temperature of about 70 to about 86°F for about 10 to about 24 hours to form a fourth mixture, adding sodium citrate to the fourth mixture to form a fifth mixture, treating the

fifth mixture with a diacetyl-producing flavor culture at about 70 to about 90°F for about 1 to about 10 days to form a sixth mixture, and treating the sixth mixture at a temperature sufficient to inactivate the cultures and enzymes in the sixth mixture to form the creamy-buttery flavor component;

wherein the cheesy flavor component is prepared by treating a third milk concentrate with a lipase, a protease, and a peptidase at a temperature of about 60 to about 140°F for about 0.5 to about 10 days to form a fifth mixture and treating the fifth mixture at a temperature sufficient to inactivate enzymes in the fifth mixture to form the cheesy flavor component; and

wherein the amounts of the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component in the cultured cheese concentrate and the amount of cultured cheese concentrate incorporated into the milk substrate can be adjusted to obtain flavored cheeses having a wide variety of flavors.

26. The method as in claim 25, wherein the first milk concentrate is also treated with a lipolytic enzyme and a high proteolytic activity culture, wherein the second milk concentrate is also treated with a lipolytic enzyme wherein the *Brevibacterium linens* culture is used to prepare the sulfury-cheddar flavor component.

27. The method as in claim 26, wherein the sulfur-containing substrate is L-methionine, L-glutathione, L-cysteine, or mixtures thereof.

28. The method as in claim 29, wherein the cultured cheese concentrate comprises about 25 to about 75 percent of the sulfury-cheddar flavor component, about 25 to about 75 percent of the creamy-buttery flavor component, and about 25 to about 75 percent of the cheesy flavor component.

29. The method as in claim 27, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*, the lipolytic enzyme used to prepare the sulfury-cheddar flavor component is pregastric esterase, and the high proteolytic activity culture used to prepare the sulfury-cheddar flavor component is a *Micrococcus*; wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof, the lipolytic enzyme used to prepare the creamy-buttery flavor component is pregastric esterase, and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc*, *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*, or mixtures thereof; and wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

30. The method of claim 27, wherein the cultured cheese concentrate is a dried powder.

31. The method of claim 29, wherein the cultured cheese concentrate is a dried powder.

32. A sulfury-cheddar flavor component for use in cheese flavoring, wherein the sulfury-cheddar flavor component is prepared by treating a milk concentrate with a lactic acid culture at a temperature of about 70 to about 86°F for about 10 to about 24 hours to obtain first mixture having a pH of about 5.4 or less, adding a sulfur-containing substrate to the first mixture to form a second mixture, treating the second mixture with a *Brevibacterium linens* culture or a yeast from the genera *Debaromyces* or *Kluyveromyces*,

whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a third mixture, and treating the third mixture at a temperature sufficient to inactivate enzymes in the third mixture to form the sulfury-cheddar flavor component.

33. The sulfury-cheddar flavor component of claim 32, wherein the milk concentrate is also treated with a lipolytic enzyme and a high proteolytic activity culture, and wherein the *Brevibacterium linens* culture is used to prepare the sulfury-cheddar flavor component.

34. The sulfury-cheddar flavor component of claim 33, wherein the sulfur-containing substrate is L-methionine, L-glutathione, L-cysteine, or mixtures thereof.

35. The sulfury-cheddar flavor component of claim 34, wherein the lactic acid culture is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*, the lipolytic enzyme is pregastric esterase, and the high proteolytic activity culture is a *Micrococcus*.

36. The sulfury-cheddar flavor component of claim 33, wherein the sulfury-cheddar flavor component is a dried powder.

37. The sulfury-cheddar flavor component of claim 34, wherein the sulfury-cheddar flavor component is a dried powder.

38. A flavoring system for food products, said system comprising a sulfury-cheddar flavor component, a creamy-buttery flavor component, and a cheesy flavor component.

wherein the sulfury-cheddar flavor component is prepared by treating a first milk concentrate with a lactic acid culture, a sulfur-containing substrate, and a *Brevibacterium linens* culture or a yeast from the genera *Debaromyces* or *Kluyeromyces*, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a first mixture, and treating the first mixture at a temperature sufficient to inactivate cultures and enzymes in the first mixture to form the sulfury-cheddar flavor component;

wherein the creamy-buttery flavor component is prepared by treating a second milk concentrate with a lactic acid culture, a diacetyl-producing flavor culture, and sodium citrate at a temperature of about 70 to about 90°F for about 1 to about 10 days to form a second mixture and treating the second mixture at a temperature sufficient to inactivate cultures and enzymes in the second mixture to form the creamy-buttery flavor component;

wherein the cheesy flavor component is prepared by treating a third milk concentrate with a lipase, a protease, and a peptidase at a temperature of about 60 to about 140°F for about 0.5 to about 10 days to form a third mixture and treating the third mixture at a temperature sufficient to inactivate enzymes in the third mixture to form the cheesy flavor component; and

wherein the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component of the cheese flavoring system can be incorporated in varying amounts into food products to produce a wide variety of flavors.

39. The flavoring system of claim 38, wherein the food products are cheese products and the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component of the flavoring system are incorporated into a cheese or dairy base to produce the cheese products.

40. The flavoring system of claim 39, wherein the first milk concentrate is also treated with a lipolytic enzyme and a high proteolytic activity culture, wherein the second milk concentrate is also treated with a lipolytic enzyme wherein the *Brevibacterium linens* culture is used to prepare the sulfury-cheddar flavor component.

41. The flavoring system of claim 40, wherein the sulfur-containing substrate is L-methionine, L-glutathione, L-cysteine, or mixtures thereof.

42. The flavoring system of claim 39, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*; wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc*, *Lactococcus lactis* ssp. *lactis* biovar. *diselylactis*, or mixtures thereof; and wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

43. The flavoring system of claim 40, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*, the lipolytic enzyme used to prepare the sulfury-cheddar flavor component is pregastric esterase, and the high proteolytic activity culture used to prepare the sulfury-cheddar flavor component is a *Micrococcus*; wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof, the lipolytic enzyme used to prepare the

creamy-buttery flavor component is pregastric esterase, and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc, Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*, or mixtures thereof; and wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

44. The flavoring system of claim 41, wherein the lactic acid culture used to prepare the sulfury-cheddar flavor component is *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*, the lipolytic enzyme used to prepare the sulfury-cheddar flavor component is pregastric esterase, and the high proteolytic activity culture used to prepare the sulfury-cheddar flavor component is a *Micrococcus*; wherein the lactic acid culture used to prepare the creamy-buttery flavor component is *Lactococcus lactis*, *Lactococcus lactis* ssp. *cremoris*, or mixtures thereof, the lipolytic enzyme used to prepare the creamy-buttery flavor component is pregastric esterase, and the diacetyl-producing flavor culture used to prepare the creamy-buttery flavor component is *Leuconostoc, Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*, or mixtures thereof; and wherein the lipase used to prepare the cheesy flavor component is a fungal lipase, the protease used to prepare the cheesy flavor component is a neutral bacterial protease, a fungal protease, or mixtures thereof, and the peptidase used to prepare the cheesy flavor component is from *Lactobacillus helveticus*.

3. Detailed Description of the Invention

Field of the Invention

The present invention relates generally to a natural biogenerated cheese flavoring system which can be used to prepare very different cheeses having desired flavor profiles. More specifically, the present invention relates to a natural biogenerated cheese flavoring system comprising a sulfury-cheddar flavored component, a creamy-buttery flavored component, and a cheesy flavored component. Each of these flavored components can be used as flavor building blocks with their own specific flavor profiles and/or characteristics. Using various combinations of these flavored components, cheeses having a wide variety of flavors can easily be produced. The flavored components are separately prepared from a highly concentrated milk substrate using ingredients (e.g., specific enzymes, cultures, and additives) and process conditions designed to provide the flavor components having specific flavor profiles and/or characteristics. The flavor components can be used in process cheese, natural cheese, or other cheeses to produce very different cheeses with desired flavor profiles. The flavor concentrates can also be used as a natural flavoring system in other food products.

Background of the Invention

Natural cheese is generally made by developing acidity in milk and setting the milk with a clotting agent, such as rennet, or by developing acidity to the isoelectric point of the protein. The set milk is cut and whey is separated from the resulting curd. The curd may be pressed to provide a cheese block. Curing typically takes place over a lengthy period of time under controlled conditions. Cheddar cheese, for example, is cured for a period of at least four months and may be cured for a period in excess of one year to obtain the full flavor desired in cheddar cheese.

It is well known to provide a product having some of the characteristics of natural cheese by grinding a natural cheese, and heating it with an

emulsifying salt. The name given to the resulting product depends upon the ingredients used and its composition and, in some instances, is determined by regulations promulgated by the U.S. Food and Drug Administration 21 C.F.R. §133.169-180. For example, the term "pasteurized process cheese" refers to a product comprising a blend of cheeses to which an emulsifying agent, usually an emulsifying salt, and possibly acids, have been added, and which has then been worked and heated into a homogeneous plastic mass. The flavor of process cheese is dependent on utilizing a high proportion of long hold (aged over four months) natural cheese. The use of long hold cheese increases the cost of process cheese due to storage and inventory costs. The yield of natural cheese produced by conventional methods is relatively low; generally about 10-12 pounds of cheese are produced per 100 pounds of milk. This also increases costs.

The term "pasteurized process cheese food" refers to a product which is prepared from the same materials and the same processes used for manufacture of process cheese. However, such cheese foods generally have dairy ingredients added thereto, such as cream, milk, skimmed milk, whey, or any of these from which part of the water has been removed (e.g., concentrated skimmed milk). The moisture level in process cheese food is generally higher than that of process cheese and may be up to about 44 percent. Fat is generally present at a level of not less than 23 percent.

The term "pasteurized process cheese spread" refers to a product which is similar to cheese food, in the sense that it can contain the indicated dairy ingredients. Process cheese spreads, however, may have moisture levels as high as 60 percent and minimum fat levels of 20 percent.

Process cheese, process cheese food, and process cheese spread are referred to as "standardized products," since their methods of manufacture and composition are determined by Federal Standards of Identity.

As used herein, the term "process cheese-type products" includes those products known and referred to as "pasteurized process cheese," "pasteurized process cheese food," "pasteurized process cheese spread,"

and "pasteurized process cheese product." "Process cheese type-products" also includes products resembling process cheese, process cheese food, process cheese spread, and process cheese product, but which may not meet the U.S. Federal Standards of Identity for any of the above products in that they may contain ingredients not specified by such Standards, such as vegetable oil or vegetable protein, or may not meet the compositional requirements of such Standards. Process cheese-type products also include products having flavor and texture similar to those of a process cheese-type product regardless of the ingredients or manufacturing steps employed, and regardless of whether the Standards have been met.

There have been many efforts to produce a naturally derived highly flavored cheese ingredient, which can be used in process cheese, in a shortened period of time. For example, U.S. Patent 4,752,483 is directed to a method for producing a highly flavored cheese ingredient. In this process, cheese curd is first produced, the resulting "green" cheddar-type cheese curds are ground and then combined with a protease, a lipase, and water and incubated for about 5 to 6 days. The term "green" cheddar-type cheese curd refers to a cheddar cheese which has been aged less than about 60 days.

U.S. Patent 4,172,900 is directed to producing a natural cheese product having a highly intensified American cheese flavor which is adapted for use in the preparation of process cheese. In the method, cheese curd is produced in the usual way, wherein a coagulum is produced from milk, the coagulum is cut to produce curds and whey and the whey is drained to provide cheese curds. The curd particles are produced, mixed with salt, a source of lipolytic enzyme, and a source of a proteolytic enzyme and cured for a period of time sufficient to produce increased levels of C_2-C_{16} fatty acids, as compared to conventional American-type cheese.

U.S. Patent 4,119,732 is directed to a method for rapidly producing cheese. In this method, rennet, kid lipase, and calf lipase are mixed with milk during the fermenting period. The milk is then coagulated and cut into curd particles followed by processing by the normal procedure for producing

cheddar cheese, which includes a whey draining step. The curd is formed into a cheese block and the cheese block is aged for about 10 weeks to provide an intense aged cheddar cheese flavor.

U.S. Patent No. 3,975,544 describes a method for producing cheddar cheese from pasteurized milk wherein an enzyme mixture is added to cheddared curds to substantially reduce the curing time of the cheese block. The cheese blocks are cured for a period of one month at 10 to 25°C.

U.S. Patent No. 4,244,971 is directed to a process for the rapid manufacture of cheese products. In the process, a cultured cheese component is prepared by proteolyzing milk protein and by lipolyzing milkfat and forming a mixed fermentate of these hydrolyzed materials. The mixed fermentate is combined with a cheese starter culture and fermented to provide the cultured cheese component. The cultured cheese component is then mixed with a milk protein concentrate and a fat concentrate. This mixture is fermented to provide a cheese material capable of being made into process cheese type products by conventional cheese cooking techniques.

Co-pending United States Patent Application Serial Number 09/314,713, filed on May 19, 1999, and owned by the same assignee as the present application, provided a method for making enzyme-modified cheese flavorings in which treatment with a proteolytic enzyme occurred prior to any heating step, and in which the enzyme treatment was relatively short (i.e., normally less than about 12 hours). This process included the steps of: (i) contacting a dairy liquid containing whey protein with a proteolytic enzyme to provide a dairy reaction mixture; (ii) incubating the dairy reaction mixture at a temperature and for a period of time that are sufficient to partially hydrolyze proteins; (iii) pasteurizing the partially hydrolyzed dairy reaction mixture; (iv) contacting the pasteurized mixture with a composition comprising a lipase and a cheese culture and incubating for a time and at a temperature that are sufficient for cheese flavor to develop; and (v) treating the fermented mixture with heat sufficient to inactivate the culture, destroy microbial contaminants,

and inactivate the enzymes; thereby providing the enzyme-modified cheese flavoring.

Co-pending United States Patent Application Serial Number 09/141,082, filed on August 27, 1998, and also owned by the same assignee as the present application, provided a method for producing a highly flavored component for use in cheese manufacture in a short period of time without utilizing a whey draining step or producing cheese curds. A cheese flavor precursor (i.e., an aqueous, acidified protein, and fat substrate) was prepared by mixing together a dried or concentrated protein source, a fat source, an acid source, and water. An enzyme system was then added to the substrate. The enzyme system included a lipase, a protease, and a peptidase. The substrate was then fermented for a time sufficient to provide a highly developed cheese flavor in the substrate. The substrate was then heated to a temperature and held at that temperature for a time sufficient to inactivate the enzyme system.

Although these methods generally provide highly flavored cheese components, they are generally limited to flavor profiles suitable for producing only a single type of flavored cheese. Thus, it is not possible to produce cheeses having widely differing and desirable flavor profiles using these methods. Moreover, none of these methods produce highly flavored cheese components having, or contributing to, sharp cheddar notes. It would be desirable, therefore, to provide a cheese flavoring system whereby cheeses having desirable and widely varying flavor profiles can be prepared. It would also be desirable to provide a cheese flavoring system which can duplicate a wide variety of desirable flavored cheeses using only a few flavoring components. It would also be desirable to provide a highly flavored cheese component having sharp cheddar notes. The present invention provides such cheese flavoring systems and a highly flavored cheese component having, or contributing to, sharp cheddar notes.

Summary of the Invention

The present invention relates generally to a natural biogenerated cheese flavoring system which can be used to prepare cheeses having desired flavor profiles. More specifically, the present invention relates to a cheese flavoring system comprising a "sulfury-cheddar" flavored component, a "creamy-buttery" flavored component, and a "cheesy" flavored component. Each of these flavored components can be used as flavor building blocks with their own specific flavor profiles and/or characteristics. Using various combinations of these flavored components (i.e., the cultured cheese concentrate of this invention), cheeses having a wide variety of flavors can be produced. The flavored components are separately prepared from a highly concentrated milk substrate using enzymes, cultures, additives, and process conditions designed to provide flavor components having specific flavor profiles and/or characteristics. The flavor concentrates can be used to prepare process cheese or other cheeses with desired flavor profiles. The flavor concentrates can be added to the milk substrate used to produce the cheese, wherein the milk substrate is then treated to produce the desired cheese. Alternatively, the flavor concentrates can be added to a cheese or dairy base (i.e., a cheese curd and/or dairy solids lacking the desired flavor profile) to produce the desired cheese. The flavor concentrates can also be used as a natural flavoring system in other food products.

The present invention provides a flavoring system comprising a sulfury-cheddar flavor component, a creamy-buttery flavor component, and a cheesy flavor component,

wherein the sulfury-cheddar flavor component is prepared by treating a first milk concentrate with a lactic acid culture, and optionally a lipolytic enzyme and a high proteolytic activity culture, at a temperature of about 70 to about 86°F for about 10 to about 24 hours to obtain first mixture having a pH of about 5.4 or less, adding a sulfur-containing substrate to the first mixture to form a second mixture, treating the second mixture with a *Brevibacterium*

linens culture or a yeast from the genera Debaromyces or Kluyeromyces, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a third mixture, and treating the third mixture at a temperature sufficient to inactivate the cultures and enzymes in the third mixture to form the sulfury-cheddar flavor component;

wherein the creamy-buttery flavor component is prepared by treating a second milk concentrate with a lactic acid culture, and optionally a lipolytic enzyme, at a temperature of about 70 to about 86°F for about 10 to about 24 hours to form a fourth mixture, adding sodium citrate to the fourth mixture to form a fifth mixture, treating the fifth mixture with a diacetyl-producing flavor culture at about 70 to about 90°F for about 1 to about 10 days to form a sixth mixture, and treating the sixth mixture at a temperature sufficient to inactivate the cultures and enzymes in the sixth mixture to form the creamy-buttery flavor component;

wherein the cheesy flavor component is prepared by treating a third milk concentrate with a lipase, a protease, and a peptidase at a temperature of about 60 to about 140°F for about 0.5 to about 10 days to form a seventh mixture and treating the seventh mixture at a temperature sufficient to inactivate enzymes in the seventh mixture to form the cheesy flavor component; and

wherein the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component of the cheese flavoring system can be incorporated in varying amounts into food products to produce a wide variety of flavors. The present flavoring system is especially adapted for incorporation into a cheese or dairy base to produce cheese products.

The present invention also provides a cheese flavoring system comprising a sulfury-cheddar flavor component, a creamy-buttery flavor component, and a cheesy flavor component,

wherein the sulfury-cheddar flavor component is prepared by treating a first milk concentrate with a lactic acid culture, optionally a lipolytic enzyme, optionally a high proteolytic activity culture, a sulfur-containing substrate, and a *Brevibacterium linens* culture or a yeast from the genera Debaromyces or Kluyeromyces, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a first mixture, and treating the first mixture at a temperature sufficient to inactivate cultures and enzymes in the first mixture to form the sulfury-cheddar flavor component;

wherein the creamy-buttery flavor component is prepared by treating a second milk concentrate with a lactic acid culture, optionally a lipolytic enzyme, a diacetyl-producing flavor culture, and sodium citrate at a temperature of about 70 to about 90°F for about 1 to about 10 days to form a second mixture and treating the second mixture at a temperature sufficient to inactivate cultures and enzymes in the second mixture to form the creamy-buttery flavor component;

wherein the cheesy flavor component is prepared by treating a third milk concentrate with a lipase, a protease, and a peptidase at a temperature of about 60 to about 140°F for about 0.5 to about 10 days to form a third mixture and treating the third mixture at a temperature sufficient to inactivate enzymes in the third mixture to form the cheesy flavor component; and

wherein the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component of the cheese flavoring system can be incorporated in varying amounts into a cheese or dairy base to produce cheeses having a wide variety of flavors.

The sharp cheddar flavor component or concentrate can also be used alone to replace aged flavored cheese in the manufacture of process cheese. Thus, the present invention also provides a process for producing a sharp cheddar flavor component or concentrate for use in cheese manufacture. This sharp cheddar flavor component or concentrate can be used alone to

add specific flavor notes to natural cheese, especially to provide sharp cheddar notes to very young cheddar cheeses. Thus, this present invention also provides a sulfury-cheddar flavor component for use in cheese flavoring, wherein the sulfury-cheddar flavor component is prepared by treating a milk concentrate with a lactic acid culture, and optionally a lipolytic enzyme and a high proteolytic activity culture, at a temperature of about 70 to about 86°F for about 10 to about 24 hours to obtain first mixture having a pH of about 5.4 or less, adding a sulfur-containing substrate to the first mixture to form a second mixture, treating the second mixture with a *Brevibacterium linens* culture or a yeast from the genera Debaromyces or Kluyeromyces, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a third mixture, and treating the third mixture at a temperature sufficient to inactivate enzymes in the third mixture to form the sulfury-cheddar flavor component.

In the method, the starting material is a milk concentrate comprising an aqueous protein and fat-containing mixture. The aqueous milk-derived concentrate (i.e., a highly concentrated milk system) generally has a total solids content of about 30 to about 50 percent, a protein content of about 10 to about 19 percent, a fat content of about 15 to about 30 percent, and a lactose content of about 0.5 to about 10 percent. Preferably, the aqueous milk-derived concentrate has a total solids content of about 35 to about 47 percent, a protein content of about 12 to about 17 percent, a fat content of about 18 to about 25 percent, and a lactose content of about 0.5 to about 5 percent. Preferably, the aqueous milk-derived concentrate or substrate is a fluid milk concentrate prepared by ultrafiltration/diafiltration (UF/DF) or a reconstituted milk substrate prepared from a mixture of UF/DF milk powder and milkfat. As shown in Figure 1, the fluid milk concentrate is then divided into three portions, each of which is treated (i.e., fermented) with specific flavor enzymes, cultures, adjuncts, and other additives for a predetermined period of time sufficient to develop specific flavor characteristics. Using this

method, a "sulfury-cheddar" component, a "creamy-buttery" component, and a "cheesy" component can be produced. Each portion is then heated to a temperature and held at that temperature for a time sufficient to inactivate the enzyme/culture systems used to prepare the specific flavoring component. Although it is generally preferred, largely for convenience, that the same or similar milk concentrate composition is used to prepare each of the three flavor components of the present cheese flavoring system, separate milk concentrate compositions can be used to prepare each of the three flavor components if desired.

After the heat inactivation steps, the three flavored components or substrates can be used separately or can be combined in groups of two or three to provide the desired highly flavored cultured concentrate. If desired, the sulfury-cheddar component, which has strong sulfur notes, can be used alone to provide sharp cheddar flavor notes. Preferably, however, the flavoring systems employs all three flavored components in varying amounts to provide a wide variety of flavored cheeses. The flavored components or concentrates can be used directly or can be dried (e.g., spray dried) to produce highly flavored cheese/dairy powders.

Either the flavored concentrates or cheese powders can be used to prepare a wide variety of flavored cheeses. This invention also provides a method of preparing a flavored cheese using a cultured cheese concentrate, said method comprising:

(1) preparing a cheese base;

(2) incorporating about 1 to about 10 percent of the cultured cheese concentrate into the cheese base to form the flavored cheese;

wherein the cultured cheese concentrate comprises 0 to about 80 percent of a sulfury-cheddar flavor component, about 10 to about 90 percent of a creamy-buttery flavor component, and about 10 to about 90 percent of a cheesy flavor component;

wherein the sulfury-cheddar flavor component is prepared by treating a first milk concentrate with a lactic acid culture, and optionally a lipolytic

enzyme and a high proteolytic activity culture, at a temperature of about 70 to about 86°F for about 10 to about 24 hours to obtain first mixture having a pH of about 5.4 or less, adding a sulfur-containing substrate to the first mixture to form a second mixture, treating the second mixture with a *Brevibacterium linens* culture or a yeast from the genera Debaromyces or Kluyeromyces, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a third mixture, and treating the third mixture at a temperature sufficient to inactivate cultures and enzymes in the third mixture to form the sulfury-cheddar flavor component,

wherein the creamy-buttery flavor component is prepared by treating a second milk concentrate with a lactic acid culture, and optionally a lipolytic enzyme, at a temperature of about 70 to about 86°F for about 10 to about 24 hours to form a fourth mixture, adding sodium citrate to the fourth mixture to form a fifth mixture, treating the fifth mixture with a diacetyl-producing flavor culture at about 70 to about 90°F for about 1 to about 10 days to form a sixth mixture, and treating the sixth mixture at a temperature sufficient to inactivate the cultures and enzymes in the sixth mixture to form the creamy-buttery flavor component;

wherein the cheesy flavor component is prepared by treating a third milk concentrate with a lipase, a protease, and a peptidase at a temperature of about 60 to about 140°F for about 0.5 to about 10 days to form a fifth mixture and treating the fifth mixture at a temperature sufficient to inactivate enzymes in the fifth mixture to form the cheesy flavor component; and

wherein the amounts of the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component in the cultured cheese concentrate and the amount of cultured cheese concentrate incorporated into the cheese base can be adjusted to obtain flavored cheeses having a wide variety of flavors.

The present invention also provides a method of preparing a flavored cheese using a cultured cheese concentrate, said method comprising:

(1) preparing a milk substrate suitable for producing a cheese;

(2) incorporating about 1 to about 10 percent of the cultured cheese concentrate into the milk substrate;

(3) treating the milk substrate and cultured cheese concentrate to set the milk substrate;

(4) cutting the set milk substrate to form curds and whey,

(5) cooking the curds and whey;

(6) separating the curds from the whey; and

(7) forming the flavored cheese from the separated curds;

wherein the cultured cheese concentrate comprises 0 to about 80 percent of a sulfury-cheddar flavor component, about 10 to about 90 percent of a creamy-buttery flavor component, and about 10 to about 90 percent of a cheesy flavor component;

wherein the sulfury-cheddar flavor component is prepared by treating a first milk concentrate with a lactic acid culture, and optionally a lipolytic enzyme and a high proteolytic activity culture, at a temperature of about 70 to about 86°F for about 10 to about 24 hours to obtain first mixture having a pH of about 5.4 or less, adding a sulfur-containing substrate to the first mixture to form a second mixture, treating the second mixture with a *Brevibacterium linens* culture or a yeast from the genera Debaromyces or Kluyveromyces, whereby the *Brevibacterium linens* culture or the yeast can convert the sulfur-containing substrate to sulfur-containing flavor compounds, at a temperature of about 65 to about 86°F for about 3 to about 10 days to form a third mixture, and treating the third mixture at a temperature sufficient to inactivate cultures and enzymes in the third mixture to form the sulfury-cheddar flavor component;

wherein the creamy-buttery flavor component is prepared by treating a second milk concentrate with a lactic acid culture, and optionally a lipolytic enzyme, at a temperature of about 70 to about 86°F for about 10 to about 24

hours to form a fourth mixture, adding sodium citrate to the fourth mixture to form a fifth mixture, treating the fifth mixture with a diacetyl-producing flavor culture at about 70 to about 90°F for about 1 to about 10 days to form a sixth mixture, and treating the sixth mixture at a temperature sufficient to inactivate the cultures and enzymes in the sixth mixture to form the creamy-buttery flavor component;

wherein the cheesy flavor component is prepared by treating a third milk concentrate with a lipase, a protease, and a peptidase at a temperature of about 60 to about 140°F for about 0.5 to about 10 days to form a fifth mixture and treating the fifth mixture at a temperature sufficient to inactivate enzymes in the fifth mixture to form the cheesy flavor component; and

wherein the amounts of the sulfury-cheddar flavor component, the creamy-buttery flavor component, and the cheesy flavor component in the cultured cheese concentrate and the amount of cultured cheese concentrate incorporated into the milk substrate can be adjusted to obtain flavored cheeses having a wide variety of flavors.

Detailed Description of the Invention

In the present method, the starting material is a milk concentrate or substrate in the form of an aqueous protein and fat-containing mixture. As noted above, although it is generally preferred, largely for convenience, that the same or similar milk concentrate composition is used to prepare each of the three flavor components of the present cheese flavoring system, separate milk concentrate compositions can be used to prepare each of the three flavor components if desired. The aqueous milk-derived concentrate or

concentrates (i.e., highly concentrated milk system) generally have total solids contents of about 30 to about 50 percent, protein contents of about 10 to about 19 percent, fat contents of about 15 to about 30 percent, and lactose contents of about 0.1 to about 10 percent. Preferably, the aqueous milk-derived concentrates have total solids contents of about 35 to about 47 percent, protein contents of about 12 to about 17 percent, fat contents of about 18 to about 25 percent, and lactose contents of about 0.5 to about 5 percent. The moisture levels of the substrate are generally from about 50 to about 70 percent, preferably from about 53 to about 65 percent. The protein source can be a dried protein or concentrated material and is preferably a dairy ingredient, such as milk protein concentrate, fractionated milk protein, concentrated milkfat, whey protein concentrate, dried whey, non-fat dry milk, or mixtures thereof. The fat source is preferably a milkfat such as anhydrous milkfat, butter, cream, or mixtures thereof. Other protein sources, such as soy protein, corn protein, wheat protein, and/or rice protein can be used. Other non-dairy fat sources, such as vegetable oil, can be used. The pH of the milk concentrate or substrate is generally in the range of about 6 to about 7 and preferably in the range of about 6.5 to about 6.7.

A dried protein source, if used, is reconstituted with water. The water is used at a level sufficient to provide a total moisture of from about 50 to about 70 percent, preferably from about 53 to about 65 percent in the substrate. The reconstituted protein source is combined with the fat source to provide the substrate. If necessary, the pH of the substrate can be lowered to the proper range (i.e., about 4.6 to about 6.0 and preferably about 4.6 to about 5.6) by the addition of an edible acid or by use of a lactic acid producing microorganism. Suitable edible acids are non-toxic, inorganic or organic acids, which include hydrochloric acid, acetic acid, maleic acid, tartaric acid, citric acid, phosphoric acid, lactic acid, and mixtures thereof. In preparing the milk concentrate, a homogenization device can be used, if desired and/or necessary, to reduce the fat droplet particle size and insure homogeneity of the substrate.

concentrates (i.e., highly concentrated milk system) generally have total solids contents of about 30 to about 50 percent, protein contents of about 10 to about 19 percent, fat contents of about 15 to about 30 percent, and lactose contents of about 0.1 to about 10 percent. Preferably, the aqueous milk-derived concentrates have total solids contents of about 35 to about 47 percent, protein contents of about 12 to about 17 percent, fat contents of about 18 to about 25 percent, and lactose contents of about 0.5 to about 5 percent. The moisture levels of the substrate are generally from about 50 to about 70 percent, preferably from about 53 to about 65 percent. The protein source can be a dried protein or concentrated material and is preferably a dairy ingredient, such as milk protein concentrate, fractionated milk protein, concentrated milkfat, whey protein concentrate, dried whey, non-fat dry milk, or mixtures thereof. The fat source is preferably a milkfat such as anhydrous milkfat, butter, cream, or mixtures thereof. Other protein sources, such as soy protein, corn protein, wheat protein, and/or rice protein can be used. Other non-dairy fat sources, such as vegetable oil, can be used. The pH of the milk concentrate or substrate is generally in the range of about 6 to about 7 and preferably in the range of about 6.5 to about 6.7.

A dried protein source, if used, is reconstituted with water. The water is used at a level sufficient to provide a total moisture of from about 50 to about 70 percent, preferably from about 53 to about 65 percent in the substrate. The reconstituted protein source is combined with the fat source to provide the substrate. If necessary, the pH of the substrate can be lowered to the proper range (i.e., about 4.6 to about 6.0 and preferably about 4.6 to about 5.6) by the addition of an edible acid or by use of a lactic acid producing microorganism. Suitable edible acids are non-toxic, inorganic or organic acids, which include hydrochloric acid, acetic acid, maleic acid, tartaric acid, citric acid, phosphoric acid, lactic acid, and mixtures thereof. In preparing the milk concentrate, a homogenization device can be used, if desired and/or necessary, to reduce the fat droplet particle size and insure homogeneity of the substrate.

As shown in Figure 1, the fluid milk concentrate, preferably containing about 1 to about 2 percent salt, is then divided into three portions, each of which is treated (i.e., fermented) with specific enzymes, cultures, adjuncts, and other additives for predetermined time periods sufficient to develop specific flavor characteristics. Specific enzymes, cultures, adjuncts, and other additives are provided from which a "sulfury-cheddar" component, a "creamy-buttery" component, ar d a "cheesy" component can be produced. Although not shown in the Figure, each component stream can be subjected to an optional homogenization step before or after fermentation. After fermentation, each portion is then heated to a temperature and held at that temperature for a time sufficient to inactivate the culture and enzyme systems.

After the heat inactivation steps, the three flavored components or substrates can be used separately or can be combined in groups of two or three to provide the desired highly flavored cultured cheese concentrate. Preferably, the cultured cheese concentrate of this invention contains 0 to about 80 percent of the sulfury-cheddar component, about 10 to about 90 percent of the creamy-buttery component, and about 10 to about 90 percent of the cheesy component. More preferably, the cultured cheese concentrate of this invention contains about 25 to about 75 percent of the sulfury-cheddar component, about 25 to about 75 percent of the creamy-buttery component, and about 25 to about 75 percent of the cheesy component. The cultured cheese concentrate can be a physical blend of the components which blend is then used to prepared the desired flavored cheese. Alternatively, the cultured cheese concentrate can be formed by individually adding the components to the cheese substrate; the resulting composition is then used to prepare the desired flavored cheese.

As illustrated in Example 5, the flavor building block materials (i.e., the three flavor components) can be added to a milk substrate which is then used to form a cheese. Alternatively and as illustrated in Example 6, the flavor building block materials can be added to an already prepared cheese base.

The relative amounts of three components in the cultured cheese concentrate, as well as the total amount of cultured cheese concentrate incorporated, can be varied to achieve particular flavor combinations or flavor notes depending on the desired flavor characteristics. Using the three components and a cheese base, a wide variety of cheese types can be prepared as illustrated in the following Table 1:

Table 1: Illustrative Cheeses Prepared Using the Cultured Cheese Concentrate of the Present Invention

Cheese		Cultured Cheese Concentrate (Parts By Weight)		
		Sulfury-Cheddar	Creamy-Buttery	Cheesy
Process Cheese		1.7	7	1.3
Cream Cheese		0	8	2
Cheddar	Medium	1	6	3
	Sharp	3.3	3.3	3.3
	Extra-Sharp	6	1	3
Mozzarella		0	7.5	2.5
Parmesan		1	3	6
Romano		1	1	8

Generally, the resulting cheeses contain about 1 to about 10 percent of the cultured cheese concentrate and preferably about 2 to about 6 percent. Of course, as those skilled in the art will realize, both the relative and total amounts of the various components can be modified and/or optimized to achieve a particularly desired flavor profile. Additionally, these three components can be used to obtain other flavored cheeses and can be used in various cheese bases (e.g., process cheeses, process cheese-type food products, natural cheeses, cream cheeses, cottage cheeses, and the like).

As noted above and shown in Figure 1, the fluid milk concentrate is divided into three portions, each of which is treated (i.e., fermented) with

specific enzymes, cultures, adjuncts, and other additives for a predetermined period of time sufficient to develop specific flavor characteristics. Specific enzymes, cultures, adjuncts, and other additives are provided from which the "sulfury-cheddar" component, the "creamy-buttery" component, and the "cheesy" component can be produced. The processes for preparing these components do not require whey drainage steps. The preparation of each of the flavor components will now be described.

Sulfury-Cheddar Component. The preparation of the sulfury-cheddar component is preferably carried out in a two stage process as illustrated in Figure 1. In the first stage, a lactic acid culture is added to the milk substrate and are maintained at about 70 to about 86°F for about 10 to about 24 hours to obtain a pH of about 5.4 or less. Preferably, a lipolytic enzyme and a high proteolytic activity culture or protease enzyme are also added with the lactic acid culture in the first stage. Then a *Brevibacterium linens* culture or a yeast from the genera *Debaromyces* or *Kluyeromyces* and a sulfur-containing substrate whereby the culture or yeast can convert the sulfur-containing substrate to organoleptically potent sulfur-containing flavor compounds is added and the fermentation continued for about 3 to 10 additional days at a temperature of about 65 to about 86°F (preferably at about 72°F). Preferably the *Brevibacterium linens* culture is used to form the sulfur-containing compounds. There should not be any heat inactivation of enzymes/cultures between the two fermentation stages. The enzymes can be produced from various microorganisms or extracted from plant or animal tissues. The various enzymes of the enzyme system are available commercially as dry powders or in liquid form. Preferably, both stages are carried out in a single vessel. Preferably, the reaction mixture is subject to aeration during fermentation to prevent anaerobic conditions and to provide good mixing. Generally, conditions should be maintained to minimize phase separation during fermentation. If phase separation does occur, an optional homogenization step can be used after fermentation. After completion of the

two fermentation steps or stages, the cultures and enzymes are inactivated by heating to about 145 to about 190°F for about 16 seconds to about 30 minutes, preferably to about 155°F for about 10 minutes. Preferably, the reaction mixture is recirculated during inactivation to improve heat transfer.

As noted, the *Brevibacterium linens* culture is preferably used to form the sulfur-containing compounds. If desired, a microorganism genetically modified so as to provide similar *Brevibacterium linens* activity can be used in place of the *Brevibacterium linens* culture. For purposes of this invention, such a genetically modified microorganism is considered to be included within the term "*Brevibacterium linens* culture."

For purposes of this invention, the "sulfur-containing substrates" are sulfur-containing free amino acids, tripeptides containing sulfur-containing amino acids, and protein hydrolysates containing sulfur-containing amino acids. Suitable food protein hydrolysates are available, for example, from Quest International (Hoffman Estates, Illinois) under tradenames N-Z-Amine, N-Z-Case, Hy-Case, and Pepticase, as well as from other suppliers. Preferably, the sulfur-containing substrates includes L-methionine, L-glutathione, and L-cysteine. In especially preferred embodiments, the sulfur-containing substrate is a mixture of L-methionine and L-glutathione, a mixturre of L-methionine and L-cysteine, or a mixture of L-methionine, L-glutathione, and L-cysteine. The sulfur-containing substrates are generally added at a level of about 0.01 to about 1 percent.

In a particular preferred embodiment, the sulfury-cheddar component is prepared by treating the milk concentrate (pH about 6.0 to about 6.7) with a lactic acid culture, a lipolytic enzyme, and a high proteolytic activity culture in a first stage and then, without any inactivation, further treating with a *Brevibacterium linens* culture with added L-methionine and L-glutathione, added L-methionine and L-cysteine, or added L-methionine, L-glutathione, and L-cysteine. The first stage is carried out for about 10 to about 24 hours at a temperature of about 70 to about 86°F. The second stage is carried out

for about 1 to 10 days, preferably for about 4 to about 8 days, at a temperature of about 70 to about 86°F. Although it is preferred that the two stages be carried out sequentially as shown in Figure 1, they may be combined into a single fermentation step. Such a single stage fermentation process is generally carried out at about 65 to about 86°F for about 3 to about 10 days.

An especially preferred composition for preparing the sulfury-cheddar component is described in the following Table 2. Example 1 illustrates the preparation of the sulfury-cheddar component using the ingredients and "typical" levels listed in Table 2.

Table 2: Especially Preferred Composition for Preparing Sulfury-Cheddar Component

Ingredient	Range (%)	Typical (%)	Function
5X UF/DF Milk	balance	96.78	milk substrate
First Stage			
Pregastric esterase	0 - 1	0.02	lipolytic enzyme for hydrolysis of fat to free fatty acids
Lactococcus lactis and *Lactococcus lactis* ssp. *cremoris*	0.001 - 2	0.01	starter culture to convert lactose to lactic acid and decrease pH
Micrococcus	0.0001 - 1	0.001	flavor adjunct culture with high proteolytic activity to convert casein to peptides
Second Stage			
Brevibacterium linens	0.001 - 2	0.01	flavor adjunct culture to produce sulfur flavor compounds
L-methionine	0.01 - 1	0.1	amino acid substrate for sulfur compound generation
L-glutathione	0.01 - 1	0.1	tri-peptide substrate and processing aid to create redox equilibrium conditions for flavor development; hydrolyzed to free amino acids

Other sulfur-containing substrates, if used, are generally present in a level of about 0.01 to about 1 percent. Fermentation is preferably carried out with aeration to prevent the reaction mixture from becoming anaerobic and to provide good mixing. Aeration is preferably effected using air introduced into the reaction mixture using a diffusion plate or an in-line air sparger. If appropriate (i.e., if phase separation occurs), the reaction mixture can optionally be homogenized prior to further treatment. After fermentation, the cultures and enzymes are inactivated by heating at about 150 to about 185°F for about 16 seconds to about 30 minutes; preferably, aeration is discontinued throughout the heat inactivation process.

The sulfur-containing substrates are added to assist in the production of sulfur compounds important in cheddar, especially sharp cheddar, flavor development. Preferred sulfur-containing substrates include L-methionine, L-glutathione, L-cysteine, and mixtures thereof. The L-methionine is used for sulfur compound generation through the action of the *Brevibacterium linens* culture or the yeast (preferably *Brevibacterium linens*). The tri-peptide L-glutathione (i.e., glutamine-cysteine-glycine) and the amino acid L-cysteine, in addition to serving as substrates, also act as processing aids to create redox equilibrium conditions which facilitate flavor production by the generation of desirable sulfur flavor compounds (i.e., methanethiol, dimethyldisulfide, and dimethyltrisulfide). Hydrolysis of L-glutathione to free amino acids by microbial enzymes is expected during the fermentation period. Further hydrolysis may also occur during subsequent heat treatment (i.e., during inactivation and/or incorporation into cheese base). Generally, expected levels of L-glutathione in the final cheese product (i.e., the flavored cheese product produced with the present cheese flavor system) are less than about 10 ppm

The resulting sulfury-cheddar component which is produced is typically a liquid or paste with a moisture content in the range of from about 50 to about 70 percent, preferably from about 53 to about 65 percent. The sulfury-cheddar component can be spray dried to provide a powder with or without

the addition of carrier materials, such as whey concentrate or maltodextrins. The sulfury-cheddar component generally has the following flavor characteristics/profile shown in Table 3. The sulfury-cheddar component likely contains other potent aroma or flavor compounds, including sulfur-containing compounds, which have not been detected.

Table 3. Typical Flavor Profile for Sulfury- Cheddar Component.

	Range	Typical
Methanethiol*	700 - 15M	3.7M
Dimethyldisulfide*	1M - 50M	9.7M
Dimethyltrisulfide*	1M - 50M	6.9M
Acetic acid	500 - 1500 ppm	916 ppm
Propionic acid	<25 - 100 ppm	<25 ppm
Butyric acid	100 - 500 ppm	266 ppm
Hexanoic acid	10 - 200 ppm	92 ppm
Octanoic acid	10 - 200 ppm	45 ppm
Decanoic acid	10 - 200 ppm	64 ppm
Dodecanoic acid	10 - 200 ppm	82 ppm

* Sulfur compounds are reported in peak value areas as determined using gas chromatography; M = million. The initial peak value areas for these sulfur compounds was essentially zero.

Creamy-Buttery Component. The preparation of the creamy-buttery component is preferably carried out in a two stage process as illustrated in Figure 1. The preparation of the creamy-buttery component is carried out by adding a lactic acid culture to the milk concentrate and then fermenting the mixture at about 70 to 85°F for about 10 to about 24 hours. Preferably, a lipolytic enzyme is also added to the milk concentrate along with the lactic acid culture. A diacetyl-producing flavor culture and sodium citrate are then added and the fermentation continued at about 70 to about 90°F, preferably about 82°F, for about 1 to about 10 days, preferably about 5 to about 8 days. The enzymes can be produced from various microorganisms or extracted

from plant or animal tissues. The various enzymes of the enzyme system are available commercially as dry powders or in liquid form. Preferably, the reaction mixture is subject to aeration during fermentation to prevent anaerobic conditions and to provide good mixing. Phase separation does is not a significant problem during fermentation. After completion of the fermentation step, the cultures and enzymes are inactivated by heating to about 145 to about 190°F for about 16 seconds to about 30 minutes, preferably to about 155°F for about 10 minutes.

In a particular preferred embodiment, the creamy-buttery component is prepared by treating the milk concentrate (pH about 6.0 to about 6.7) with a lactic acid culture and a pregastric esterase in a first stage and then, without any inactivation, adding sodium citrate (generally about 0.05 to about 5 percent) and further treating with one or more cultures which have the ability to produce diacetyl from citrate. Preferred diacetyl-producing cultures include Leuconostoc and *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis*. The first stage fermentation is carried out for about 10 to about 24 hours at a temperature of about 70 to about 86°F. The second stage is carried out for about 1 to about 10 days at a temperature of about 70 to about 90°F. Although it is preferred that the two stages be carried out sequentially as shown in Figure 1, they may be combined into a single fermentation step. Such a single stage fermentation process is generally carried out at a temperature of about 70 to 90°F for about 1 to about 10 days.

As noted, the Leuconostoc and *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis* cultures are the preferred diacetyl-producing flavor cultures. If desired, a microorganism genetically modified so as to provide similar activity can be used in place of the Leuconostoc and/or *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactis* cultures. For purposes of this invention, such a genetically modified microorganism is considered to be included within the term "diacetyl-producing flavor cultures."

An especially preferred composition for preparing the creamy-buttery component is described in the following Table 4. Example 2 illustrates the preparation of the creamy-buttery component using the ingredients and "typical" levels listed in Table 2.

Table 4: Especially Preferred Composition for Preparing Creamy-Buttery Component

Ingredient	Range (%)	Typical (%)	Function
5X UF/DF Milk	balance	99.83	milk substrate
First Stage			
Pregastric esterase	0 - 1	0.02	lipolytic enzyme for hydrolysis of fat to free fatty acids
Lactococcus lactis and *Lactococcus lactis* ssp. *cremoris*	0.001 - 2	0.01	starter culture to convert lactose to lactic acid and decrease pH
Second Stage			
Sodium Citrate	0.01 - 10	0.3	substrate for diacetyl production and flavor generation
Leuconostoc	0 - 1	0.0001	flavor adjunct culture for production of diacetyl from citrate
Lactococcus lactis ssp. *lactis* biovar. *diacetylactis*	0 - 1	0.0001	flavor adjunct culture for production of diacetyl from citrate

After fermentation, the cultures and enzymes are inactivated by heating at about 145 to about 190°F for about 16 seconds to about 30 minutes, preferably to about 155°F for about 10 minutes. Preferably, aeration is not used during or after the heat inactivation process.

The resulting creamy-buttery component which is produced is typically a liquid or paste with a moisture content in the range of from about 50 to about 70 percent, preferably from about 53 to about 65 percent. The creamy-buttery component can be spray dried to provide a powder with or without the

addition of carrier materials, such as whey concentrate or maltodextrins. The creamy-buttery component generally has the flavor characteristics/profile shown in Table 5. The creamy-buttery component likely contains other potent aroma or flavor compounds which have not been detected.

Table 5. Typical Flavor Profile for Creamy-Buttery Component.

	Range (ppm)	Typical (ppm)
Ethanol	1 - 150	41
Acetone	1 - 5	2
Diacetyl	20 - 400	176
Acetic acid	400 - 1000	660
Propionic acid	<25 - 100	<25
Butyric acid	200 - 500	275
Hexanoic acid	20 - 150	85
Octanoic acid	10 - 100	30
Decenoic acid	50 - 150	86
Dodecanoic acid	50 - 150	106

Cheesy Component. The cheesy component can generally be prepared using the starting materials and procedures described in co-pending United States Patent Application Serial Number 09/141,082, filed on August 27, 1998, which is hereby incorporated by reference. The enzyme system used to prepare the cheesy component includes a lipase, a protease, and a peptidase. The substrate is treated with the enzyme system at a temperature of from about 60 to about 140°F for a period of from about 0.5 to about 10 days, preferably from about 1 to about 3 days, to reach the desired cheesy flavor level. The enzymes can be produced from various microorganisms or extracted from plant or animal tissues. The various enzymes of the enzyme system are available commercially as dry powders or in liquid form.

Lipase (sometimes referred to as an esterase) is an enzyme which is well known in the art. Lipase are typically derived from the gullet tissues of young animals (calves, kids, or lambs), from the pancreas of adult animals, or from microbial sources. Various commercial preparations derived from gullet tissue are available from SKW BioIndustries, Marschall Laboratory, or other such companies under various trade names. The enzyme can be manufactured by grinding edible gullet with salt and non-fat dry milk, drying the mixture, and grinding again. Microbial sources of lipase are, for example, the molds *Candida cylindracea* Type VIII, *Aspergillus oryzae*, *A. niger*, *Penicillium roquefortl*, *P. glaucum*, and *Rhizopus oryzae*.

In preparing the cheesy component, a powdered lipase (preferably a fungal lipase) is generally used at a level of about 0.05 to about 0.4 percent. A suitable fungal lipase is commercially available from Biocatalysts under the tradename Lipomod 187.

Proteases are enzymes which can be derived from fungal, plant, or animal sources, as is well-known in the art. Examples of suitable proteases include Enzeco Neutral Bacterial Protease 2X available from Enzyme Development Corp. and Promod 215 available from Biocatalyst. The powdered proteases are generally used at levels of from about 0.01 to about 1 percent, preferably at levels of from 0.1 to about 0.4 percent.

An enzyme with peptidase activity, preferably amino peptidase activity, is used in the enzyme system; such enzymes act upon bitter flavored peptides that result from protein hydrolysis. The peptidase enzyme in concert with the protease enzyme creates a high concentration of free amino acids and small peptides which contribute to the cheese flavor. The peptidase can be a purified enzyme material or can be cells of a microbe which produces peptidase activity, such as *Lactobacillus helveticus*. The culture cells can be spray dried, freeze dried, frozen, or freshly cultured cells and can be non-growing or capable of propagation within the substrate. Spray dried *Lactobacillus helveticus* cells are used at a level of from about 0.01 to about 3

percent, preferably from about 0.05 to about 0.30 percent. The preferred enzymes are powders. However, suitable liquid forms of these enzymes would be acceptable for use in this invention.

The substrate is treated with the enzyme system for a period of from about 0.5 to about 10 days, preferably from about 1 to about 3 days, to reach the desired cheesy flavor level. The treatment is conducted at a temperature of from about 60 to about 140°F. The desired flavor level can be judged organoleptically and can be estimated through analytical measurements, such as pH, titratable acidity, and concentration of free fatty acids and amino acids. When the target flavor is reached, the enzymes are deactivated by heating the mixture to a temperature of from about 160 to about 210°F and holding the substrate at the elevated temperature for a sufficient time to insure complete enzyme deactivation (e.g., from about 5 to about 60 minutes).

The enzymes may be added sequentially or all at once to provide desired flavor profile. In the sequential addition of the enzymes, one or more of the enzymes is added and a treatment period of from about 4 hours to about 5 days is conducted. The remaining enzymes are then added and the treatment continues for further predetermined time of from about 0.5 to about 5 days. There is no inactivation step between the sequential addition of the enzymes.

In another embodiment of the invention, a first enzyme treatment takes place at a relatively high temperature of from about 120 to about 140°F. At least one of the enzymes is added and is incubated at this temperature for a first treatment of from about 2 to about 6 hours. The remaining enzymes are then added for a second treatment period of from about 6 hours to about 10 days which takes place at a temperature of from about 60 to about 140°F.

The process can be, and preferably is, conducted in a single vessel without transfer to additional vessels for sequential steps. The vessel is preferentially provided with mixing equipment to insure good contact between the enzymes and the substrate materials and to maintain the solids in suspension. A scraped surface mixing tank is preferred. A recirculation and

homogenization device may be employed to prevent segregation of a fat phase from aqueous materials and to aid in maintaining the solids in suspension. Water may be added during the fermentation to maintain desired moisture content and acidic or basic materials may be added to adjust the pH.

In a particular preferred embodiment, the cheesy component is prepared by treating the milk concentrate (pH about 6.0 to about 6.7) with added monsodium phosphate with a neutral bacterial protease, an enzyme with aminopeptidase activity, a fungal protease, and a fungal lipase for about two days at a temperature of about 100 to about 110°F as shown in Figure 1.

An especially preferred composition for preparing the cheesy component is described in the following Table 6. Example 3 illustrates the preparation of the cheesy component using the ingredients and "typical" levels listed in Table 2.

Table 6: Especially Preferred Composition for Preparing Cheesy Component

Ingredient	Range (%)	Typical (%)	Function
5X UF/DF Milk	balance	96.2	milk substrate
Monosodium Phosphate	0.1 - 3	1.0	emulsifier to aid in maintaining solids in suspension
Neutral bacterial protease (Enzeco Neutral Bacterial Protease 2X, Enzyme Development Corp.)	0.01 - 1	0.15	neutral bacterial protease for hydrolysis of milk proteins to polypeptides, peptides, and amino acids for flavor generation
Lactobacillus helveticus (EnzoBact, Medipharm)	0.01 - 3	0.14	debittering agent; aminopeptidase activity
Fungal Protease (Promod 215, Biocatalysts)	0.01 - 1	0.28	proteolytic enzyme for hydrolysis of milk proteins to polypeptides, peptides, and amino acids for flavor generation
Fungal Lipase (Lipomod 187, Biocatalysts)	0.01 - 1	0.12	lipase enzyme for hydrolysis of fat to free fatty acids and development of lipolytic flavor notes
Sorbic Acid	0.01 - 0.5	0.1	mold inhibitor

Fermentation is preferably carried out with recirculation using a shear pump to prevent the reaction mixture from becoming anaerobic and to provide good mixing. After fermentation, the enzymes are inactivated by applying heat (generally about 185°F for about 30 minutes); preferably, recirculation is continued throughout the heat inactivation process but without using the shear pump. The preferred cheesy component prepared with the ingredients in the above Table generally has improved flavor characteristics (i.e., a stronger cheesy "bite") than similar components prepared using the specific starting materials and procedures described in co-pending United States Patent Application Serial Number 09/141,082.

The resulting cheesy component which is produced is typically a liquid or paste with a moisture content in the range of from about 50 to about 70

percent, preferably from about 53 to about 65 percent. The cheesy component can be spray dried to provide a powder with or without the addition of carrier materials, such as whey concentrate or maltodextrins. The cheesy component generally has the flavor characteristics/profile shown in Table 7. The cheesy component likely contains other potent aroma or flavor compounds which have not been detected.

Table 7. Typical Flavor Profile for Cheesy Component.

	Range	Typical
Gel Profile	9 - 34 k (100%)	9 - 11 k (100%)
Protease activity	4 - 25 Fl. intensity units/min/g	9.66 Fl. intensity units/min/g
Acetic acid	10 - 100 ppm	35 ppm
Propionic acid	<25 ppm - 100	<100 ppm
Butyric acid	2000 - 7000 ppm	5823 ppm
Hexanoic acid	1000 - 6000 ppm	3254 ppm
Octanoic acid	1000 - 4000 ppm	2922 ppm
Decanoic acid	4000 -10000 ppm	6230 ppm
Dodecanoic acid	4000 - 10000 ppm	7145 ppm

The following examples further illustrate various features of the invention, but are intended to in no way limit the scope of the invention as set forth in the appended claims. Unless otherwise noted, all percentages and ratios are by weight. All reference cited in the present specification are hereby incorporated by reference.

Example 1. This example illustrates the preparation of the sulfury-cheddar component. Fresh whole milk was combined with fresh cream in an amount sufficient to obtain a standardized milk with a fat content of about 54 percent based on dry matter. The standarized milk was pasteurized in a high temperature heat exchanger (HTST) at 164°F for 16 seconds and then

cooled to 130°F. The cooled milk was then concentrated to 5X in a spiral wound ultrafiltration (UF) system with difiltration (DF) to reduce the lactose content to about 1 percent. The UF/DF milk (4222 pounds), with 2 percent added salt, was heat treated at 155°F for 10 minutes in a agitated, jacketed vessel and then cooled to 78°F. The milk concentrate contained 41.8 percent solids, 22.6 percent fat, and 16.4 percent protein and had a pH of 6.4.

Lactic acid starter culture (0.01 percent; *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*; R603 from Chr. Hansens, Inc.), *Micrococcus* (0.001 percent), and pregastric esterase (0.02 percent) were added to the milk concentrate and fermented in a first stage for 17 hours at 75°F to reach a pH of 5.16. L-methionine (0.1 percent), L-glutathione (0.1 percent), and an activated culture of *Brevibacterium linens* (1 percent) were added to the first stage fermentation product to initiate the second stage of the fermentation process. Prior to its use, the *Brevibacterium linens* culture was activated under aerobic conditions for 48 hours at 75°F in tryptic soy broth (TSB). The second stage fermentation was continued for an additional 7 days with aeration at a temperature of 72°F; the pH at the end of the second stage was 6.75. The level of sulfur compounds (i.e., methanethiol, dimethyldisulfide, and dimethyltrisulfide) increased dramatically during the fermentation process (see results in Table 3). The resulting sulfury-cheddar component was heated to 155°F for ten minutes in order to inactivate the cultures and enzymes and to extend the shelf life of the product. A relatively small loss of sulfur compounds was observed in the deactivation step. The flavor profile for the resulting sulfury-cheddar component is in Table 3 above under the heading "Typical." The sulfury-cheddar component had a total solids of about 41 percent and could, if desired, be spray dried to form a sulfury-cheddar flavor powder.

Example 2. This example illustrates the preparation of the creamy-buttery component. A milk concentrate similar to the one prepared in Example 1 was used as the starting substrate.

Lactic acid starter culture (0.01 percent; *Lactococcus lactis* and *Lactococcus lactis* ssp. *cremoris*; R603 from Chr. Hansens, Inc.)and pregastric esterase (0.02 percent) were added to the milk concentrate and fermented in a first stage for 17 hours at 75°F to reach a pH of 5.16. After heating to 82°F, sodium citrate (0.2 percent) and activated cultures of Leuconostoc (0.1 percent) and *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactic* (0.1 percent) were added to the first stage fermentation product to initiate the second stage of the fermentation process. Prior to their use, the Leuconostoc and *Lactococcus lactis* ssp. *lactis* biovar. *diacetylactic* cultures were activated overnight at 75°F in MRS broth. The second stage fermentation was continued for an additional 6 days with aeration at a temperature of 82°F; the pH at the end of the second stage was 5.26. The diacetyl level increased from an initial value of about 1 ppm to about 176 ppm at the end of the second stage. The resulting creamy-buttery component was heated to 155°F for ten minutes in order to inactivate the cultures and enzymes and to extend the shelf life of the product. A relatively small loss of diacetyl was observed in the deactivation step. The flavor profile for the resulting creamy-buttery component is in Table 5 above under the heading "Typical." The creamy-buttery component had a total solids of about 42 percent and could, if desired, be spray dried to form a creamy-buttery flavor powder.

Example 3. This example illustrates the preparation of the cheesy component. A milk concentrate was prepared using milk protein concentrate (MPC) powder, water, anhydrous milk fat, and salt.

MPC powder and salt were hydrated with warm water in a Vacuum-Cam injection mixer to form a protein slurry. The protein slurry was transferred to an agitated jacketed vessel with continuous recirculation using a shear pump. Melted anhydrous milkfat was then added to form the milk concentrate. The resulting milk concentrate contained 43.5 percent solids.

18.6 percent fat, 13.7 percent protein, 2.8 percent lactose, and 1.85 percent salt.

The milk concentrate was maintained in the same agitated jacketed vessel with continuous recirculation using a shear pump during the fermentation process. Monosodium phosphate (0.5 percent) was added and the slurry was heated at 162°F for 15 minutes. After cooling to 104°F, an enzyme slurry containing neutral bacterial protease (about 0.18 percent; Enzeco Neutral Bacterial Protease 2X, Enzyme Development Corp.), *Lactobacillus helveticus* (about 0.14 percent; EnzoBact, Medipharm), fungal protease (about 0.28 percent; Promod 215, Biocatalysts), and fungal lipase (about 0.28 percent; Lipomod 187, Biocatalysts); percentages are based on the total weight of the fermentation mixture. Fermentation was continued for 48 hours at 104°F with continuous agitation and recirculation using the shear pump to maintain an emulsion. After completion of the fermenation, the enzymes were inactivated by heating to 185°F for 30 minutes; aeration was continued during inactivation but without using the shear pump. The flavor profile for the resulting cheesy component is in Table 7 above under the heading "Typical." Sorbic acid (about 0.1 percent) was then added. The cheesy component had a total solids of about 43 percent and could, if desired, be spray dried to form a cheesy flavor powder.

Example 4. Thirty-four pounds milk (3.5 percent butterfat) and 0.75 ml double strength annatto color were added to a small cheese vat at a temperature of 88°F. Frozen, pelleted starter culture (2.45 g; Chr. Hansens, Inc.) was added and the mixture allowed to ripen for 30 minutes. The flavor building block materials (i.e., sulfury-cheddary, creamy-buttery, and cheesy components produced in Examples 1, 2, and 3, respectively, at a 1:1:1 ratio; 30 g total) was mixed into the ripened milk. Rennet (1.7 ml Chymax Extra; Chr. Hansens, Inc.) was then added and the resulting mixture allowed to coagulate for 30 minutes without agitation. The set curd was then cut into 3/8 inch cubes and allowed to rest for 15 minutes. After this rest period, the curd was gently agitated by hand while increasing the temperature to 102°F over a

thirty minute period. The curd was cooked at 102°F for one hour, at which time the whey was allowed to drain from the curd. The curd was allowed to fuse into a solid mass and flipped every 15 minutes over a 90 minute period. The resulting small slab was milled into ½ x ½ x 2 inch pieces. Three applications of salt (12.9 g/application) were made with 5 minute intervals between each application. The resulting salted curd was placed in small cheese hoops and pressed overnight. After pressing, the cheese was placed in a vacuum chamber and pressed for an additional hour. The fully pressed cheese was vacuum sealed in plastic until evaluation. Control cheese was prepared in the same manner except that the flavor building block materials were not included. The cheese prepared using the flavor build block materials provided good flavor and organoleptic characteristics.

Example 6. Thirty-four pounds milk (3.5 percent butterfat) and 0.75 ml double strength annatto color were added to a small cheese vat at a temperature of 88°F. Frozen, pelleted starter culture (2.45 g; Chr. Hansens, Inc.) was added and the mixture allowed to ripen for 30 minutes. Rennet (1.7 ml Chymax Extra; Chr. Hansens, Inc.) was then added and the resulting mixture allowed to coagulate for 30 minutes without agitation. The set curd was then cut into 3/8 inch cubes and allowed to rest for 15 minutes. After this rest period, the curd was gently agitated by hand while increasing the temperature to 102°F over a thirty minute period. The curd was cooked at 102°F for one hour, at which time the whey was allowed to drain from the curd. The curd was allowed to fuse into a solid mass and flipped every 15 minutes over a 90 minute period. The resulting small slab was milled into ½ x ½ x 2 inch pieces. Freeze-dried flavor building block materials (i.e., sulfury-cheddar, creamy-buttery, and cheesy components produced in Examples 1, 2, and 3, respectively, at a 1:1:1 ratio; 30 g total) was mixed with 38.9 g salt) and then divided into three portions. Three applications of the building block materials and salt mixture (22.9 g/application) were made with 5 minute intervals between each application. The resulting salted curd was placed in small cheese hoops and pressed overnight. After pressing, the cheese was

placed in a vacuum chamber and pressed for an additional hour. The fully pressed cheese was vacuum sealed in plastic until evaluation. Control cheese was prepared in the same manner except that the flavor building block materials were not included. The cheese prepared using the flavor build block materials provided good flavor and organoleptic characteristics.

Example 6. Using the sulfury-cheddar flavor component prepared in Example 1, the creamy-buttery flavor component prepared in Example 2, and the cheesy flavor component prepared in Example 3, a pasteurized process cheese spread loaf having sharp cheddar flavor notes was prepared. About 1 percent of the sulfury-cheddar flavor component, about 4 percent of the creamy-buttery flavor component, and about 1 percent of the cheesy component were added to a mixture of young and mild cheeses. Other ingredients were then added at the following levels:

Whey Powder	<1%
Milk Protein Concentrate	<1%
Sorbic Acid	<0.5%
Cheese Color	<0.5%
Monosodium Phosphate & Disodium Phosphate	~3%

The resulting cheese mixture was processed in a Damrow laydown direct steam injected cooker (Damrow Co., Inc., Fond du Lac, Wisconsin) at 175°F. The hot melted cheese was formed into 2 pound loaves and cooled in a forced air cooler to 40°F. The resulting pasteurized process cheese spread loaf had flavor, texture, and meltability similar to prepared cheese products made with aged cheddar cheese.

4. Brief Description of the Drawings

Figure 1 illustrates the preparation of the cultured cheese concentrate containing the sulfury-cheddar flavor component, the creamy-butter flavor component, and the cheesy flavor component of the present invention.

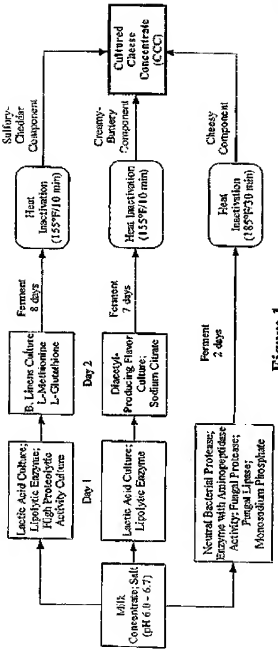
Milk Concentrate; Salt (pH 6.0 - 6.7)
Lactic Acid Culture; Lipolytic Enzyme; High Proteolytic Activity Culture
Lactic Acid Culture; Lipolytic Enzyme
Neutral Bacterial Protease; Enzyme with Aminopeptidase Activity; Fungal Protease; Yeast Extract; Monosodium Phosphate
Day 1
B. Linens Culture; L-Methionine L-Glutathione
Diacetyl-Producing Flavor Culture; Sodium Citrate
Day 2
Ferment 8 days
Ferment 7 days
Ferment 2 days
Heat Inactivation (155°F/10 min)
Heat Inactivation (155°F/10 min)
Heat Inactivation (185°F/30 min)
Sulfury-Cheddar Component
Creamy-Buttery Component
Cheesy Component
Cultured Cheese Concentrate (CCC)

Figure 1

1. Abstract

A natural biogenerated cheese flavoring system is provided which can be used to prepare very different cheeses having desired flavor profiles. More specifically, the present cheese flavoring system comprising a sulfury-cheddar flavored component, a creamy-buttery flavored component, and a cheesy flavored component. Each of these flavored components can be used as flavor building blocks with their own specific flavor profiles and/or characteristics. Using various combinations of these flavored components, cheeses having a wide variety of flavors can be produced. The flavored components are separately prepared from a highly concentrated milk substrate using compositions (e.g., specific enzymes, cultures, and additives) and process conditions designed to provide the flavored components having specific flavor profiles and/or characteristics. The flavor concentrates can be used in process cheese, process cheese-type products, or other cheeses to produce very different cheeses with desired flavor profiles. The flavor concentrates can also be used as a natural flavoring system in other food products.

2. Representative Drawing

Figure .1